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1. **Numerical study on biomass model compound gasification in a supercritical water fluidized bed reactor**  
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1. **A Conceptual Map of the Lean Nomenclature: Comparing Expert Classification to the Lean Literature**

Mirdad, WK (Mirdad, Waleed K.); Eseonu, CI (Eseonu, Chinweike I.)

**Abstract**

Although the implementation of lean can yield improvements in organizational performance, the literature suggests that most organizations are unable to effectively sustain the results from lean implementation efforts. The lack of clarity related to lean concepts may be a cause of unsuccessful implementation. In this work, we seek to clarify conceptual ambiguity in the lean nomenclature. Using an extensive literature review, we document lean principles, practices, and performance measures. Results from a survey of lean experts were used to investigate the relationship between lean principles and practices. Findings from the literature and from the expert survey were synthesized to develop a visual representation of the lean nomenclature. This conceptual map is intended to aid practitioners by increasing clarity of important lean concepts and thus, the probability of successful implementation.
2. A Constraint Transformation Technique in Petri Nets with Backward-Conflict-Free Uncontrollable Structures

Ma, ZY (Ma, Ziyue); Li, ZW (Li, Zhiwu); Giua, A (Giua, Alessandro)

Abstract

In this paper we study the problem of constraint transformation for Petri nets. We consider a special class of systems in which the uncontrollable subnet is backward-conflict-free, and a new special class of GMECs called singular GMECs. We propose an algorithm to transform a given uncontrollable singular GMEC into an equivalent controllable OR-GMEC. The algorithm is based on the composition technique of GMECs.
3. A parallel distributed computing framework for Newton-Raphson load flow analysis of large interconnected power systems

Kumar, RS (Kumar, R. Sreerarma); Chandrasekharan, E (Chandrasekharan, E.)

Abstract

This paper proposes a simple parallel and distributed computing framework for the conventional Newton-Raphson load flow (NRLF) solution of large interconnected power systems. The proposed approach is based on message-passing distributed-memory architecture with separate workstations, and involves the piecewise analysis of power systems utilizing the network tearing procedure. The NRLF solution method, applied to each torn system at the selected buses, employs the matrix inversion lemma consisting of the factorization, forward elimination and back substitution procedures. The computational requirements of the state-of-the-art parallel algorithm to obtain the correction vector involved in the back substitution procedure is reduced with the proposed approach in which the back substitution is carried out in parallel taking into account the split buses, rather than the order in which the forward elimination is performed. The investigations are carried out on the IEEE 118 bus standard test system in a Redhat Linux based 100 Mbps Ethernet LAN environment. The investigations reveal that the proposed method is significantly faster than the conventional NRLF and also the NRLF based on the state-of-the-art parallel algorithm, and thus finds potential applications for the real-time load flow solution of both regulated and deregulated power systems distributed over large geographical areas. (C) 2015 Elsevier Ltd. All rights reserved.
4. A two-stage method for member selection of emergency medical service

Chen, X (Chen, Xi); Fan, ZP (Fan, Zhiping); Li, ZW (Li, Zhiwu); Han, XL (Han, Xueliang); Zhang, X (Zhang, Xiao); Jia, HC (Jia, Haochen)

Abstract

Member selection is an important decision making problem in the formation of emergency medical teams. It involves selecting an optimal combination from a reasonable number of doctors, nurses and emergency medical technicians. Selecting suitable members for a medical emergency team (MET) will facilitate the effectiveness of emergency medical service (EMS). Essentially, investigations on EMS could offer models which increase the efficiency of proper matching and earn time to save lives. The existing methods for member selection pay much attention to the individual information to measure the individual performance of members, while few studies focus on the collaborative information to measure the collaborative performance between members. This paper aims to propose a two-stage method for member selection of an MET. In the first stage, knowledge rules are proposed to identify the valid candidates quickly. In the second stage, the individual information of members, the collaborative information between members, and the response time of EMS are all considered to build a three-objective 0-1 programming model. Due to its intractability, the model is solved by a non-dominated sorting genetic algorithm II. Liberia, now suffering the Ebola virus, is used as a backdrop for this study. A practical example followed by a computational simulation experiment is used to illustrate the applicability and the effectiveness of the proposed method.

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5. Archimedean-Compensatory Fuzzy Logic Systems

Espin-Andrade, RA (Espin-Andrade, Rafael A.); Caballero, EG (Gonzalez Caballero, Erick); Pedrycz, W (Pedrycz, Witold); Gonzalez, ERF (Fernandez Gonzalez, Eduardo R.)

Abstract

The paper aims to define a new kind of logic, referred to as Archimedean-Compensatory Logic, which is constructed from the unification of two different fuzzy logic systems, namely a continuous Archimedean fuzzy logic and a compensatory fuzzy logic. The paper introduces basic definitions and properties of this new theory. Continuous Archimedean logic is a t-norm and t-conorm logic system and Compensatory Fuzzy Logic can be obtained from quasi-arithmetic mean operators. We will prove the property that the preference over a pair of truth-value vectors is the same for certain predicates in the Compensatory Fuzzy Logic and the Continuous Archimedean Logic.
6. **Bridging the Gap Between Transmission Noise and Sampled Data for Robust Consensus of Multi-Agent Systems**

Liu, KX (Liu, Kexin); Zhu, HH (Zhu, Henghui); Lu, JH (Lu, Jinhu)

**Abstract**

It is well known that multi-agent systems (MASs) are ubiquitous in natural and artificial systems. This paper aims at bridging the gap between transmission noise and sampled data for robust consensus of MASs. In detail, we have developed a theoretical framework for analyzing the robust consensus of MASs with sampled-data controllers and transmission noises. Using the delay-input and discretization approaches, we obtain two sufficient conditions on the existence of sampling periods and controller parameters for robust consensus of MASs, respectively. In particular, we deduce the estimates of the convergence speeds of consensus errors for the above two methods. Finally, numerical simulations are also given to validate our theoretical results.

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7. Coevolution of aspirations and cooperation in spatial prisoner's dilemma game

Chen, W (Chen, Wei); Wu, T (Wu, Te); Li, ZW (Li, Zhiwu); Wang, L (Wang, Long)

Abstract

Suboptimal outcomes are often more acceptable than the best ones when the latter are hard or even impossible to find. In order to describe the emergence of cooperation when suboptimal alternatives prevail, an evolutionary game model is established by considering the effects of aspirations. A win-stay-lose-shift like rule for strategy updating is proposed. The rule prescribes that if the payoff of the current strategy is greater than the aspiration, the strategy remains, otherwise the strategy changes. Aspiration updating allows for individuals to adjust their expected payoff levels. It is shown that suboptimal alternatives can promote the emergence and persistence of cooperation over a wide range of the temptation to defect. Furthermore, a nontrivial phenomenon is found that cooperators prevail as the temptation increases when it is small. The aspirations are stabilized at an intermediate level which can most facilitate cooperation. The obtained results also show that the average level of aspirations decreases as the temptation increases. Furthermore, the variance of aspiration levels is minimized for an intermediate level of temptation.

Ma, ZY (Ma, Ziyue); Li, ZW (Li, Zhiwu); Giua, A (Giua, Alessandro)

Abstract

This note shows by means of simple counterexamples that some key results presented by Luo et al. on the synthesis of maximally permissive supervisors based on the Uncontrollable Transition Gain Transformation method are incorrect. As a result, the transformation of inadmissible generalized mutual exclusion constraints for Petri nets is still an open issue. (C) 2014 Elsevier Ltd. All rights reserved.
9. Corrosion Imaging and Thickness Determination Using Micro-Curie Radiation Sources Based on Gamma-Ray Backscattering: Experiments and MCNP Simulation

Abdul-Majid, S (Abdul-Majid, Samir); Balamesh, A (Balamesh, Ahmed); Al Othmany, D (Al Othmany, Dheya); Alassiaa, A (Alassiaa, Ahmed); Al-Huraibi, H (Al-Huraibi, Hussein)

Abstract

Gamma radiography is used to monitor the corrosion of pipelines in remote locations; usually high radioactivity ($10^{11}$-$10^{12}$ Bq) is used. The technique is also not useful for imaging pipes with thick walls or large vessel walls. In this work, Compton backscattered radiation was used for the wall-thickness determination and corrosion imaging of pipe and flat materials using extremely-low-activity sources with radioactivities on the order of $10^4$-$10^5$ Bq. A two-dimensional scanning system was designed to scan object surfaces, and the signals from a NaI(Tl) scintillation detector were fed into a computer for image construction using the LabView program. Thicknesses greater than 1 cm and 1.5 cm could be measured for Fe and Al and for polyvinyl chloride (PVC) and poly methyl methacrylate (PMMA), respectively. It was also possible to detect changes of less than 1 mm in depression depth for depressions measuring 3 mm in diameter. One- and two-dimensional images artificial defects on a pipe surface were successfully constructed.

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10. Cotton derived carbonaceous aerogels for the efficient removal of organic pollutants and heavy metal ions

Chen, H (Chen, He); Wang, XX (Wang, Xiangxue); Li, JX (Li, Jiaxing); Wang, XK (Wang, Xiangke)

Abstract

Well-structured cotton derived porous carbon (CDPC) and cotton derived porous carbon oxide (CDPCO) were fabricated via a facile and economic alkaline etching method and were used as adsorbents for waste water cleanup. As a carbon source, natural cotton waste was dehydrated with sodium hydroxide at low temperatures and further etched at high temperatures in a thermal treatment process. The synthesized CDPCO exhibited an excellent adsorption performance of organic pollutants and heavy metal ions such as methylene blue, 1-naphthylamine, Cd(II) and Co(II) in aqueous solutions. The adsorption mechanism was investigated via FT-IR analysis and controlled experiments, and it was concluded that the organic pollutant removal was affected by the molecular size of the organic pollutants and the ionic interactions between the pollutants and adsorbents. The adsorption of heavy metal ions was dependent on the interactions between the heavy metal ions and functional groups on the adsorbents' surfaces. The adsorption process fitted the Langmuir model better than the Freundlich model. Our results suggested that CDPC could be a favorable adsorbent for the removal of organic pollutants and heavy metal ions from aqueous solutions.

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Research Areas: Chemistry; Energy & Fuels; Materials Science
Faculty Name: Faculty of Engineering
DSR No.: 8141
11. DC-to-DC Converter With Low Input Current Ripple for Maximum Photovoltaic Power Extraction

El Khateb, AH (El Khateb, Ahmad H.); Abd Rahim, N (Abd Rahim, Nasrudin); Selvaraj, J (Selvaraj, Jeyraj); Williams, BW (Williams, Barry W.)

Abstract

This paper presents a dc-to-dc converter, which offers continuous input and output energy flow and low input current ripple, applicable and mandatory for photovoltaic (PV) arrays and maximum power tracking applications. The PV array yields exponential curves for current and voltage where maximum power occurs at the curve's mutual knee. Conventional dc-to-dc converters have a relatively high input current ripple which causes high power losses when connected to nonlinear sources like PV arrays. The proposed converter maximizes the power that can be sourced from the PV array, without the need of any electrolytic filtering capacitance. The effect of current ripple can be significant and decreases PV system efficiency. Converter simulations and experimental results support and extol the system concept.

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Web of Science Categories: Automation & Control Systems; Engineering, Electrical & Electronic; Instruments & Instrumentation
Research Areas: Automation & Control Systems; Engineering; Instruments & Instrumentation
Faculty Name: Faculty of Engineering
DSR No.: 6677
12. Decentralized Supervision of Petri Nets With a Coordinator

Ye, JH (Ye, Jianhong); Li, ZW (Li, Zhiwu); Giua, A (Giua, Alessandro)

Abstract

This paper develops a decentralized supervision policy for a Petri net through collaboration between a coordinator and subnet controllers. The coordinator is chosen from the subnet controllers by solving an integer linear programming problem. An optimal objective function is used to minimize the communication cost between the subnet controllers and the coordinator. Furthermore, a protocol to reach an agreement on the firing conditions of common transitions among the subnet controllers is proposed. Observation agreement and control agreement can be achieved by the "AND" operator in logic algebra. Control agreement is used to decide the firing conditions of common transitions in the next step. The firing of common transitions, which will lead to a new marking that violates the given constraints, will be forbidden by the control agreement. A feasibility analysis of the proposed decentralized control framework is discussed. Finally, four examples are presented to illustrate the proposed approach.

Ma, ZY (Ma, Ziyue); Li, ZW (Li, Zhiwu); Giua, A (Giua, Alessandro)

Abstract

In this paper, a type of specifications called OR-AND Generalized Mutual Exclusion Constraints (GMEC) for place/transition nets is defined. Such a specification consists of a disjunction of conjunction of several single GMECs, i.e., the requirement is that, at any given time, the controlled system should satisfy at least one set of conjunctive GMECs. We show that a bounded OR-AND GMEC can be enforced by a special control structure composed by a set of AND-GMEC monitor places plus a switcher that determines the current active ones. We also show that such a simple control structure can be modified to ensure maximal permissiveness. This approach can be used in the framework of supervisory control in Petri nets.
14. Development of CFRE composite scarf adhesive joints with SiC and Al2O3 nanoparticle

Khashaba, UA (Khashaba, U. A.); Aljinaidi, AA (Aljinaidi, A. A.); Hamed, MA (Hamed, M. A.)

Abstract

The present work aims to strengthen scarf adhesive joints (SAJs) with 5 degrees and 10 degrees scarf angles in carbon fiber composite adherends via introducing SiC and Al2O3 nanoparticles into the adhesive epoxy. The SAJs were characterized under thermal and moisture environments. The ultimate tensile strengths (UTSs) of 5 degrees and 10 degrees SAJs were respectively improved by 41.2% and 8.4% for SiC/E-SAJs and 22.5% and 26.5% for Al2O3-SAJS compared to neat epoxy-SAJs. The UTSs and stiffness of the moist SAJs were marginally decreased. Although the UTSs of SAJs were decreased at 50 degrees C, the strain at ultimate load and fracture toughness were tremendously increased and accordingly, the SAJs are not prone to sudden failure. Interfacial shear cracks were initiated between the adhesive layer and the stiffer-adherends at the joint-overlaps, whereas the adhesive layer remains attached to the lower stiffness adherend tip-ends. Crack initiation was detected effectively at about 65% of urs of the SAJs using instrumented-SAJs with eight strain gauges. Applying such technique on composite structures can contribute in prolonging their service life by carrying out the necessarily repairs before the catastrophic failure of the structure. The experimental and predicted UTSs of SAJs using three-dimensional finite element analysis model are in good agreement, R-2 = 0.9884. (C) 2015 Elsevier Ltd. All rights reserved.
15. Discontinuous Lyapunov approach to state estimation and filtering of jumped systems with sampled-data

Liu, XY (Liu, Xiaoyang); Yu, WE (Yu, Wenwu); Cao, JD (Cao, Jinde); Chen, S (Chen, Shun)

Abstract

This paper is concerned with the sampled-data state estimation and H-infinity filtering for a class of Markovian jump systems with the discontinuous Lyapunov approach. The system measurements are sampled and then transmitted to the estimator and filter in order to estimate the state of the jumped system under consideration. The corresponding error dynamics is represented by a system with two types of delays: one is from the system itself, and the other from the sampling period. As the delay due to sampling is discontinuous, a corresponding discontinuous Lyapunov functional is constructed, and sufficient conditions are established so as to guarantee both the asymptotic mean-square stability and the H∞ performance for the filtering error systems. The explicit expressions of the desired estimator and filter are further provided. Finally, two simulation examples are given to illustrate the design procedures and performances of the proposed method. (C) 2015 Elsevier Ltd. All rights reserved.
16. Distributed finite-time containment control for second-order nonlinear multi-agent systems

He, XY (He, Xiaoyan); Wang, QY (Wang, Qingyun); Yu, WW (Yu, Wenwu)

Abstract

This paper considers the finite-time containment control problem for a class of second-order nonlinear multi-agent systems with external disturbances under the directed topology graph. The considered nonlinear systems are composed of multiple dynamic leaders, and they have only a subset of the followers with their accessing to the leaders. Firstly, by using the one-hop neighbors' information, a second-order finite-time distributed observer estimator protocol is constructed to achieve accurate estimation of the weighted average of the velocities and positions of the leaders. Furthermore, it is proved that the proposed estimator protocol can guarantee accurate estimation of the weighted average of the velocities and positions of the leaders in the finite-time. Then, we design a new continuous nonlinear control protocol by means of the nonsingular terminal sliding mode. It is shown that by using proposed control protocol, the states of the followers can converge to the convex hull spanned by those of the leaders in the finite-time. In addition, the finite convergence time can be also explicitly estimated. Finally, the effectiveness of the obtained theoretical results is illustrated by the numerical simulation. (C) 2015 Elsevier Inc. All rights reserved.
17. Distributed node-to-node consensus of multi-agent systems with time-varying pinning links

Wen, GH (Wen, Guanghui); Yu, WW (Yu, Wenwu); Wang, JY (Wang, Jingyao); Xu, DB (Xu, Dabo); Cao, JD (Cao, Jinde)

Abstract

In this paper, the distributed node-to-node consensus problem is addressed for a class of linear multi-agent systems with time-varying pinning links by using relative state feedback. The coordination goal in the present work is to make the states of each follower track those of its corresponding leader asymptotically where only a small fraction of followers can sense the states of their corresponding leaders through some switched communication channels. By using tools from M-matrix theory and stability analysis of switched systems theory, it is theoretically shown that such a node-to-node consensus in the closed-loop multi-agent systems can be guaranteed if each follower can be directly or indirectly influenced by at least one leader over some uniformly bounded time intervals, with the inner coupling matrix as well as the coupling strength being appropriately designed. Distributed node-to-node consensus for multi-agent systems with general Lipschitz-type nonlinear dynamics is also investigated. Numerical simulations are finally performed to verify the effectiveness of the theoretical results. (C) 2014 Elsevier B.V. All rights reserved.
Dynamic Low-Power Reconfiguration of Real-Time Systems With Periodic and Probabilistic Tasks

Wang, X (Wang, Xi); Khemaissia, I (Khemaissia, Imen); Khalgui, M (Khalgui, Mohamed); Li, ZW (Li, ZhiWu); Mosbahi, O (Mosbahi, Olfa); Zhou, MC (Zhou, MengChu)

Abstract

This paper deals with the dynamic low-power reconfiguration of a real-time system. It processes periodic and probabilistic tasks that have hard/soft deadlines corresponding to internal/external events. A runtime event-based reconfiguration scenario is a dynamic operation allowing the addition/removal of the assumed periodic/probabilistic tasks. Thereafter, some tasks may miss their hard deadlines and the power consumption may increase. In order to reconfigure the system to be feasible, i.e., satisfying its real-time constraints with low-power consumption, this research presents a software-agent-based architecture. An intelligent agent is developed, which provides four solutions to reconfigure the system at runtime. For these solutions, in order to reconfigure the probabilistic tasks to be feasible, the agent modifies their temporal parameters dynamically; moreover, in order to feasibly serve the probabilistic tasks and reduce the system’s power consumption, the agent provides three virtual processors by dynamically extending the periods of the periodic tasks. A simulation study verifies the effectiveness of the agent.

Note to Practitioners: This study addresses new challenges in the real-time industrial systems by proposing original solutions for their low-power reconfiguration. This contribution is significant for future generations of low-power technology. A runtime event-based reconfiguration scenario is technically defined as any operation that works by adding/removing tasks. An agent-based architecture is developed, where an intelligent software agent is implemented to check the system’s runtime evolution. The agent presents useful technical solutions to reconfigure the system in order to meet the temporal constraints of the tasks and satisfy the system’s low-power consumption. It can also be deployed in reconfigurable real-time embedded systems such as lap-tops, mobile phones, and personal digital assistants.
Faculty Name: Faculty of Engineering
Department Name: No Department
DSR No.: 8297
19. Effect of operating parameters on boron removal from seawater using membrane distillation process

Boubakri, A (Boubakri, Ali); Bouguecha, SAT (Bouguecha, Salah Al-Tahar); Dhaouadi, I (Dhaouadi, Imen); Hafiane, A (Hafiane, Amor)

Abstract

Theoretical and experimental studies of direct contact membrane distillation (DCMD) using commercially flat sheet hydrophobic polyvinylidene fluoride (PVDF) membrane were investigated to remove boron from simulated and natural seawater. Mass transfer mechanism and theoretical flux were determined using the dusty-gas model (DGM). Mass transfer analysis showed that the combined Knudsen-molecular model is considered to be the dominant mechanism which describes the transport of water vapor through the membrane pores. Then, the effect of various operating parameters such as feed temperature, boron concentration, salt concentration and feed solution pH on DCMD performance was investigated. Experimental runs showed that the permeate flux was enhanced exponentially with feed temperature, and maximum permeate flux of 27.5 kg/m(2).h was obtained at 74 degrees C. The permeate flux decreases slightly with feed boron and salt concentration. Feed solution pH had no significant effect on DCMD performance. DCMD process can produce water with high boron rejection of more than 90% even at feed concentration as high as 200 mg/L Natural seawater, containing 537 mg/L of boron, was treated by DCMD process. During 18 h of working period, the permeate flux had showed a reduction of about 15.75%, and permeate boron was kept below 0.47 mg/L. The decreasing of contact angle value can explain the performance decline of DCMD process. (C) 2015 Elsevier B.V. All rights reserved.
20. Effect of silicate on U(VI) sorption to gamma-Al2O3: Batch and EXAFS studies

Mei, HY (Mei, Huiyang); Tan, XL (Tan, Xiaoli); Yu, SJ (Yu, Shujun); Ren, XM (Ren, Xuemei); Chen, CL (Chen, Changlun); Wang, XK (Wang, Xiangke)

Abstract

The effect of soluble silicate on the sorption of U(VI) to gamma-Al2O3 was investigated by batch experiments and extended X-ray absorption fine structure (EXAFS) method. The presence of silicate enhanced the sorption of U(VI) on gamma-Al2O3 surface and the sorption was attributed to inner-sphere surface complexation. The structure of the adsorbed U(VI) and silicate on gamma-Al2O3 was investigated in the analysis of EXAFS spectra. The fitting of the experimental EXAFS data was obtained by including two uranium coordination shells with 2 axial (O-ax) and 5 equatorial (O-eq) oxygen atoms at 1.79 +/- 0.02 and 2.43 +/- 0.02 Å, respectively, and the third coordination shells with Al atom at similar to 3.35 angstrom. Silicate contributed to the formation of ternary inner-sphere surface complexes, acting as "bridge" between U(VI) and gamma-Al2O3 and enhanced the sorption of U(VI). The observations suggested that the interactions between U(VI) and silicate were important in controlling U(VI) retention.

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Wang, XX (Wang, Xiangxue); Lu, SS (Lu, Songsheng); Chen, L (Chen, Lei); Li, JX (Li, Jiaxing); Dai, SY (Dai, Songyuan); Wang, XK (Wang, Xiangke)

Abstract

The bentonite has been studied extensively to preconcentrate radionuclides from aqueous solutions, however, the low sorption capacity limits its application in real work. Herein, bentonite embedded in the polyacrylamide (PAAm) gels is synthesized and used as a novel adsorbent for the removal of Eu(III) from aqueous solutions. The bentonite-PAAm composites show much higher sorption capacity for Eu(III) preconcentration than bare bentonite. The bentonite-PAAm composites can be used as super-adsorbent for the removal of Eu(III) from aqueous solution in radioactive pollution cleanup.
Abstract

In this paper, we introduce the local fractional Christoffel index symbols of the first and second kind. The divergence of a local fractional contravariant vector and the curl of local fractional covariant vector are defined. The fractional intrinsic derivative is given. The local fractional Riemann-Christoffel and Ricci tensors are obtained. Finally, the Einstein tensor and Einstein field are generalized by involving the fractional derivatives. Illustrative examples are presented.
23. Fabrication of fungus/attapulgite composites and their removal of U(VI) from aqueous solution

Cheng, WC (Cheng, Wencai); Ding, CC (Ding, Congcong); Sun, YB (Sun, Yubing); Wang, XK (Wang, Xiangke)

Abstract

A new adsorbent of fungus/attapulgite (F/ATP) composites was synthesized by one-pot hydrothermal carbonization method under mild conditions and characterized by scanning electron microscope, X-ray diffraction, thermogravimetric analysis and Fourier transform infrared spectroscopy. The characterized results showed that the fungus (Geotrichum sp. dwc-1) can be as a superior template for the assembly of nanoscale attapulgite by covalent bonding. According to batch experiments, the maximum sorption capacity of F/ATP for U(VI) was 125 mg/g at pH 4.0 and T = 303 K. The thermodynamic parameters calculated from sorption isotherms showed that U(VI) sorption on F/ATP was a spontaneous and endothermic process. The fixed-bed column experiment further demonstrated that F/ATP presented the excellent adsorption performance. It was determined from regeneration experiments that the F/ATP composites exhibited high sorption of U(VI) (similar to 91%) over six cycles. Therefore, F/ATP can be as a promising candidate for the removal of U(VI) from aqueous solution due to its low-cost, sustainable, and efficient feature. (C) 2015 Elsevier B.V. All rights reserved.
24. **Finite-time distributed cooperative attitude tracking control for multiple rigid spacecraft**

He, XY (He, Xiaoyan); Wang, QY (Wang, Qingyun); Yu, WW (Yu, Wenwu)

**Abstract**

We investigate the finite-time cooperative attitude synchronization and tracking control for multiple rigid spacecrafts with a time-varying leader, whose attitude is represented by modified Rodriguez parameters. In particular, the studied systems are composed of one dynamic leader with bounded unknown acceleration inputs and some followers with bounded disturbances. A novel nonlinear tracking control protocol is constructed via nonsingular terminal sliding mode scheme. It is shown that the proposed protocol can effectively drive the states of the followers to track the leader within the finite-time. Finally, an example is illustrated to verify the proposed protocol. (C) 2015 Elsevier Inc. All rights reserved.

**Sources**

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Research Areas: Mathematics
Faculty Name: Faculty of Engineering
DSR No.: 6713
25. Finite-time stochastic synchronization of genetic regulatory networks

Jiang, NJ (Jiang, Nan); Liu, XY (Liu, Xiaoyang); Yu, WW (Yu, Wenwu); Shen, J (Shen, Jun)

Abstract

This paper is concerned with the finite-time synchronization for a class of stochastic genetic regulatory networks (GRNs). The purpose of the addressed problem is to design a controller that can synchronize the concentration of the mRNA and the protein of GRNs in finite time with probability. Based on the recent finite-time stability theorem of stochastic nonlinear systems, sufficient conditions are first established for ensuring the finite-time stochastic stability of synchronization error in probability. Then, the gain parameters of the controller are obtained by solving a linear matrix inequality and the robust finite-time synchronization is guaranteed for GRNs with uncertain parameters. Compared with the previous references, a continuous finite-time controller is designed to achieve the synchronization objective and a constructive method that may accelerate the convergence is discussed. Finally, two numerical examples are given to illustrate the effectiveness of the proposed design method. (C) 2015 Elsevier B.V. All rights reserved.
26. Finite-time synchronisation control of complex networks via non-smooth analysis

Liu, XY (Liu, Xiaoyang); Yu, WW (Yu, Wenwu); Cao, JD (Cao, Jinde); Alsaadi, F (Alsaadi, Fuad)

Abstract

This study is concerned with the finite-time synchronisation control (FTSC) of complex networks with discontinuous and continuous node dynamics. Two types of controllers (including continuous and discontinuous ones) are designed to ensure synchronisation of networks based on non-smooth analysis. Many sufficient criteria are given to guarantee FTSC by utilising the famous finite-time stability theorem. Compared the new obtained results with the previous literatures, the FTSC is discussed firstly when the node dynamics as well as the controllers are both discontinuous. Meanwhile, the upper bound of the settling time for synchronisation can be estimated. Finally, numerical examples are given to illustrate the effectiveness of the theoretical results.

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Web of Science Categories: Automation & Control Systems; Engineering, Electrical & Electronic; Instruments & Instrumentation
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Faculty Name: Faculty of Engineering
DSR No.: 6273
27. Finite-time synchronization of coupled discontinuous neural networks with mixed delays and nonidentical perturbations

Yang, XS (Yang, Xinsong); Song, Q (Song, Qiang); Liang, JL (Liang, Jinling); He, B (He, Bin)

Abstract

This paper is concerned with the finite-time synchronization in an array of coupled neural networks with discontinuous activation functions, discrete and unbounded distributed delays (mixed delays), and normbounded nonidentical perturbations. Under the framework of Filippov solution, we first derive some general sufficient conditions to guarantee the global existence of the solutions to the neural networks with discontinuous activation functions and mixed delays. Then, by designing simple controller, applying some new analytical techniques, and constructing some new Lyapunov-Krasovskii functionals, several sufficient conditions are derived to ensure the finite-time synchronization of the considered networks. Moreover, the setting time is also estimated for the network under study with bounded delays or without delays. In sharp contrast to the existed results which can only finite-timely synchronize or stabilize the non-delayed systems, the theoretical results of this paper are more general and rigorous. Finally, numerical simulations are provided to illustrate the effectiveness of the theoretical analysis. (C) 2015 The Franklin Institute. Published by Elsevier Ltd. All rights reserved.

Sources

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Web of Science Categories: Automation & Control Systems; Engineering, Multidisciplinary; Engineering, Electrical & Electronic; Mathematics, Interdisciplinary Applications
Research Areas: Automation & Control Systems; Engineering; Mathematics
Faculty Name: Faculty of Engineering
DSR No.: 5056
28. Functional characteristics of additional positive feedback in genetic circuits

Wang, P (Wang, Pei); Zhang, YH (Zhang, Yuhuan); Lu, JH (Lu, Jinhu); Yu, XH (Yu, Xinghuo)

Abstract

Multiple-positive feedback circuits are ubiquitous regulatory motifs in complex bio-molecular networks. A popular topic is why multiple-positive feedback mechanisms have been evolved and selected by organisms. To this end, a two-component dual-positive feedback genetic circuit is investigated, which consists of an auto-activation loop and a double negative feedback circuit. The auto-activation loop acts as an additional positive feedback loop (APFL), and our aim is to explore the functional characteristics of the APFL. Investigations reveal that the APFL can regulate the size of bistable region and the robust attractiveness of stable steady states. It is also found that the APFL can regulate global relative input-output sensitivities of the system. Furthermore, the APFL can tune the response speed, noise resistance and stochastic switch behavior of the system, which makes it easy to realize functional tunability and robust decision-making. Therefore, rationalizing why multiple-positive feedback circuits so frequently appear in real-world biological systems. Potential applications of the associated investigations include the design of artificial genetic circuits, the modeling and model reduction for large-scale bio-molecular networks.
29. **Graphene oxides for simultaneous highly efficient removal of trace level radionuclides from aqueous solutions**

**Wang, XX** (Wang, Xiangxue); **Chen, ZS** (Chen, Zhongshan); **Wang, XK** (Wang, Xiangke)

**Abstract**

Graphene oxides (GOs) were synthesized via modified Hummers method, and were applied as adsorbents to remove radionuclides from large volumes of aqueous solutions. The single and competitive sorption of four radionuclides (i.e., U(VI), Eu152+154(III), Sr85+89(II) and Cs134(I)) on the GOs from aqueous solutions were investigated as a function of pH, ionic strength and radionuclide initial concentrations using batch technique. The results showed that the GOs had much higher sorption capacity than many other contemporary materials, for the preconcentration of radionuclides from large volumes of aqueous solutions. The sorption of radionuclides on GOs obeyed the Langmuir model, and was mainly attributed to surface complexation via the coordination of radionuclides with the oxygen-containing functional groups on GO surfaces. The competitive sorption results indicated that the selectivity sorption capacities were U(VI)> Eu(III)> Sr(II)> Cs(I). The GOs are suitable materials for the efficient removal and preconcentration of radionuclides from aqueous solutions in nuclear waste management and environmental pollution cleanup.

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**Faculty Name**: Faculty of Engineering

**DSR No.**: 4796
30. High performance of phosphate-functionalized graphene oxide for the selective adsorption of U(VI) from acidic solution

Liu, X (Liu, Xia); Li, JX (Li, Jiaxing); Wang, XX (Wang, Xiangxue); Chen, CL (Chen, Changlun); Wang, XK (Wang, Xiangke)

Abstract

In this study, phosphate-functionalized graphene oxide (PGO) was prepared by grafting triethyl phosphite onto the surface of GO using Arbuzov reaction. The as-prepared PGO was characterized by scanning electron microscopy, X-ray photoelectron spectroscopy, Fourier transformed infrared spectroscopy and Zeta potential. The application of the PGO to remove U(VI) from aqueous solution was investigated with a maximum adsorption capacity of 251.7 mg/g at pH = 4.0 +/- 0.1 and T = 303 K. The adsorption mechanism was also investigated by X-ray photoelectron spectroscopy analysis, indicating a chemical adsorption of U(VI) on PGO surface. Moreover, experimental results gave a better removal efficiency toward U(VI) on PGO surface than other heavy metal ions at acidic solution, indicating the selective extraction of U(VI) from environmental pollutants. (C) 2015 Elsevier B.V. All rights reserved.
31. Interactions of Eu(III) and Am-243(III) with humic acid-bound gamma-Al2O3 studied using batch and kinetic dissociation techniques

Wang, XX (Wang, Xiangxue); Li, JX (Li, Jiaxing); Dai, SY (Dai, Songyuan); Hayat, T (Hayat, Tasawar); Alsaedi, A (Alsaedi, Ahmed); Wang, XK (Wang, Xiangke)

Abstract

The association of Eu(III) and Am-243(III) with humic acid-bound gamma-Al2O3 (HA-Al2O3) was investigated using batch technique and the kinetic dissociation properties were studied using chelating resin. The results indicated that Eu(III) and Am-243(III) had very similar sorption properties. The kinetics of desorption of (243)(III) from HA-Al2O3 hybrids were studied at three different pH values (pH 4.0, 5.0 and 6.0) after aging time for 2 h, 4 days, and 1 month by adding chelating resin to remove the desorbed free Am-243 (III) ions from the HA-Al2O3 hybrids. The fraction of Am-243(III) on the irreversible binding sites of the HA-Al2O3 hybrids increased as the pH increased. Two different Am-243(III)-HA-Al2O3 species (i.e., "fast" and "slow" dissociation kinetics, which represented the "weak" and "strong" species on reversible sites) were required to fit the kinetic dissociation results. Although Am-243(III) was initially a "fast" dissociating species, it became a "slow" dissociating species as the aging time increased and at low HA concentrations. When the HA concentration was high, the "fast" and "slow" dissociating species of Am-243(III) bound to HA-Al2O3 particles were not influenced by the aging time. These results describe the physicochemical behavior of trivalent lanthanides and actinides in the natural environment, which is important to understand the potential pollution of long-lived radionuclides. (C) 2015 Elsevier B.V. All rights reserved.
Investigation of interaction between U(VI) and carbonaceous nanofibers by batch experiments and modeling study

Zhang, R (Zhang, Rui); Chen, CL (Chen, Changlun); Li, J (Li, Jie); Wang, XK (Wang, Xiangke)

Abstract

Carbonaceous nanofibers (CNFs) were synthesized using tellurium nanowires as a template and using glucose as carbon source by the hydrothermal carbonization method. The sorption capacity and mechanism of U(VI) on CNFs were investigated by a combination of batch sorption experiments, the double layer model (DLM) and X-ray photoelectron spectroscopy (XPS). The sorption edges were modeled well by considering the following surface complexes: equivalent to SOUO2+, equivalent to SOUO2OH, equivalent to SOUO2(OH)(2)(-) and equivalent to SOUO2(OH)(3)(2-) on the strong site as well as equivalent to XOOUO2OH and equivalent to XOOUO2+ on the weak one (S and X represent surface). The sorption isotherms could be well fitted by the DLM parameters. The difference between type A (equivalent to SOUO2OH and equivalent to XOOUO2OH) and type B (equivalent to SOUO2+ and equivalent to XOOUO2+) was observed in XPS because the former species are of low binding energy while the latter are of high one. Desorption and recycle experiments showed that CNEs had good reusability and stability in the present of common sodium salts within five rounds. When co-existing with montmorillonite, CNEs could extract the sorbed uranium onto their surface by a pseudo-second order kinetic process. As a new sort of environmental functional nanomaterials, CNFs should be paid more attention in the area of separation and wastewater remediation. (C) 2015 Elsevier Inc. All rights reserved.
33. MAF-PLL With Phase-Lead Compensator

Golestan, S (Golestan, Saeed); Guerrero, JM (Guerrero, Josep M.); Abusorrah, AM (Abusorrah, Abdullah M.)

Abstract

A basic approach to improve the filtering capability of a standard phase-locked loop (PLL) is to incorporate a moving average filter (MAF) into its control loop. This improvement, however, is at the cost of a slow transient response for the PLL, which is undesirable in most applications. It is shown in this paper that this problem can be alleviated by adding a phase-lead compensator in the MAF-PLL control loop. The effectiveness of the suggested approach is confirmed through numerical results.
34. Magnetohydrodynamic (MHD) flow of Cu-water nanofluid due to a rotating disk with partial slip

Hayat, T (Hayat, Tasawar); Rashid, M (Rashid, Madiha); Imtiaz, M (Imtiaz, Maria); Alsaedi, A (Alsaedi, Ahmed)

Abstract

This paper investigates MHD steady flow of viscous nanofluid due to a rotating disk. Water is treated as a base fluid and copper as nanoparticle. Nanofluid fills the porous medium. Effects of partial slip, viscous dissipation and thermal radiation are also considered. Similarity transformations reduce the nonlinear partial differential equations to ordinary differential equations. Flow and heat transfer characteristics are computed by HAM solutions. Also computations for skin friction coefficient and Nusselt number are presented and examined for pertinent parameters. It is noted that higher velocity slip parameter decreases the radial and azimuthal velocities while temperature decreases for larger values of the thermal slip parameter. Also the rate of heat transfer enhances when the nanoparticle volume fraction increases. (C) 2015 Author(s).

Gong, WQ (Gong, Weiqiang); Liang, JL (Liang, Jinling); Cao, JD (Cao, Jinde)

Abstract

In this paper, based on the matrix measure method and the Halanay inequality, global exponential stability problem is investigated for the complex-valued recurrent neural networks with time-varying delays. Without constructing any Lyapunov functions, several sufficient criteria are obtained to ascertain the global exponential stability of the addressed complex-valued neural networks under different activation functions. Here, the activation functions are no longer assumed to be derivative which is always demanded in relating references. In addition, the obtained results are easy to be verified and implemented in practice. Finally, two examples are given to illustrate the effectiveness of the obtained results. (C) 2015 Elsevier Ltd. All rights reserved.
36. Modeling and Verification of Reconfigurable and Energy-Efficient Manufacturing Systems

Zhang, JF (Zhang, Jiafeng); Khalgui, M (Khalgui, Mohamed); Boussahel, W (Boussahel, WassimMohamed); Frey, G (Frey, Georg); Hon, CT (Hon, ChiTin); Wu, NQ (Wu, Naiqi); Li, ZW (Li, Zhiwu)

Abstract

This paper deals with the formal modeling and verification of reconfigurable and energy-efficient manufacturing systems (REMSs) that are considered as reconfigurable discrete event control systems. A REMS not only allows global reconfigurations for switching the system from one configuration to another, but also allows local reconfigurations on components for saving energy when the system is in a particular configuration. In addition, the unreconfigured components of such a system should continue running during any reconfiguration. As a result, during a system reconfiguration, the system may have several possible paths and may fail to meet control requirements if concurrent reconfiguration events and normal events are not controlled. To guarantee the safety and correctness of such complex systems, formal verification is of great importance during a system design stage. This paper extends the formalism reconfigurable timed net condition/event systems (R-TNCESs) in order to model all possible dynamic behavior in such systems. After that, the designed system based on extended R-TNCESs is verified with the help of a software tool SESA for functional, temporal, and energy-efficient properties. This paper is illustrated by an automatic assembly system.
New sufficient conditions for observer-based control of fractional-order uncertain systems

Ibrir, S (Ibrir, Salim); Bettayeb, M (Bettayeb, Maamar)

Abstract

New simple linear matrix inequalities are proposed to ensure the stability of a class of uncertain fractional-order linear systems by means of a fractional-order deterministic observer. It is shown that the conditions of existence of an observer-based feedback can be split into a set of linear matrix inequalities that are numerically tractable. The presented results show that it is possible to decouple the conditions containing the bilinear variables into separate conditions without imposing equality constraints or considering an iterative search of the controller and the observer gains. Simulations results are given to approve the efficiency and the straightforwardness of the proposed design. (C) 2015 Elsevier Ltd. All rights reserved.
38. Noise-resistant joint diagonalization independent component analysis based process fault detection

Tian, XM (Tian, Xuemin); Cai, LF (Cai, Lianfang); Chen, S (Chen, Sheng)

Abstract

Fast independent component analysis (FastICA) is an efficient feature extraction tool widely used for process fault detection. However, the conventional FastICA-based fault detection method does not consider the ubiquitous measurement noise and may exhibit unsatisfactory performance under the adverse effects of the measurement noise. To solve this problem, we propose a new process fault detection method based on noise-resistant joint diagonalization independent component analysis (NRJDICA), which explicitly takes the measurement noise into consideration. Specifically, the NRJDICA algorithm is developed to estimate the mixing matrix and the independent components (ICs) by whitening the measured variables and performing the joint diagonalization of the whitened variables' time-delayed covariance matrices. The relationships between the kurtosis statistics of the ICs and the fourth-order cross cumulant statistics of the measured variables are then derived based on the estimated mixing matrix to help sorting the estimated ICs and selecting the dominant ICs. The serial correlation information of each dominant IC is next estimated by using a moving window technique, based on which a monitoring statistic is constructed to conduct fault detection. The simulation studies using a three-variable system and a continuous stirred tank reactor show that the proposed method has superior fault detection performance over the traditional FastICA-based fault detection. (C) 2014 Elsevier B.V. All rights reserved.
Abstract

An efficient data based-modeling algorithm for nonlinear system identification is introduced for radial basis function (RBF) neural networks with the aim of maximizing generalization capability based on the concept of leave-one-out (LOO) cross validation. Each of the RBF kernels has its own kernel width parameter and the basic idea is to optimize the multiple pairs of regularization parameters and kernel widths, each of which is associated with a kernel, one at a time within the orthogonal forward regression (OFR) procedure. Thus, each OFR step consists of one model term selection based on the LOO mean square error (LOOMSE), followed by the optimization of the associated kernel width and regularization parameter, also based on the LOOMSE. Since like our previous state-of-the-art local regularization assisted orthogonal least squares (LROLS) algorithm, the same LOOMSE is adopted for model selection, our proposed new OFR algorithm is also capable of producing a very sparse RBF model with excellent generalization performance. Unlike our previous LROLS algorithm which requires an additional iterative loop to optimize the regularization parameters as well as an additional procedure to optimize the kernel width, the proposed new OFR algorithm optimizes both the kernel widths and regularization parameters within the single OFR procedure, and consequently the required computational complexity is dramatically reduced. Nonlinear system identification examples are included to demonstrate the effectiveness of this new approach in comparison to the well-known approaches of support vector machine and least absolute shrinkage and selection operator as well as the LROLS algorithm.
40. Novel fungus-Fe3O4 bio-nanocomposites as high performance adsorbents for the removal of radionuclides

Ding, CC (Ding, Congcong); Cheng, WC (Cheng, Wencai); Sun, YB (Sun, Yubing); Wang, XK (Wang, Xiangke)

Abstract

The bio-nanocomposites of fungus-Fe3O4 were successfully synthesized using a low-cost self-assembly technique. SEM images showed uniform decoration of nano-Fe3O4 particles on fungus surface. The FTIR analysis indicated that nano-Fe3O4 was combined to the fungus surface by chemical bonds. The sorption ability of fungus-Fe3O4 toward Sr(II), Th(IV) and U(VI) was evaluated by batch techniques. Radionuclide sorption on fungus-Fe3O4 was independent of ionic strength, indicating that inner-sphere surface complexion dominated their sorption. XPS analysis indicated that the inner-sphere radionuclide complexes were formed by mainly bonding with oxygen-containing functional groups (i.e., alcohol, acetal and carboxyl) of fungus-Fe3O4. The maximum sorption capacities of fungus-Fe3O4 calculated from Langmuir isotherm model were 100.9, 223.9 and 280.8 mg/g for Sr(II) and U(VI) at pH 5.0, and Th(IV) at pH 3.0, respectively, at 303 K. Fungus-Fe3O4 also exhibited excellent regeneration performance for the preconcentration of radionuclides. The calculated thermodynamic parameters showed that the sorption of radionuclides on fungus-Fe3O4 was a spontaneous and endothermic process. The findings herein highlight the novel synthesis method of fungus-Fe3O4 and its high sorption ability for radionuclides. (C) 2015 Elsevier B.V. All rights reserved.
41. On the enforcement of a class of nonlinear constraints on Petri nets

Chen, YF (Chen, YuFeng); Li, ZW (Li, ZhiWu); Barkaoui, K (Barkaoui, Kamel); Giua, A (Giua, Alessandro)

Abstract

This paper deals with the enforcement of nonlinear constraints on Petri nets. A supervisory structure is proposed for a class of nonlinear constraints. In order to enforce a nonlinear constraint on a Petri net, we propose a transition transformation technique to replace a transition in an original net by a set of transitions. Then, a control place is designed to control the firing of these transitions, aiming to enforce the nonlinear constraint. The proposed supervisor is maximally permissive in the sense that it can make all markings in the admissible-zone reachable and all markings in the forbidden-zone unreachable. The proposed method is applicable to bounded Petri nets. Finally, a number of examples are provided to demonstrate the proposed approach. (C) 2015 Elsevier Ltd. All rights reserved.

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Plasma-induced grafting of polyacrylamide on graphene oxide nanosheets for simultaneous removal of radionuclides

Song, WC (Song, Wencheng); Wang, XX (Wang, Xiangxue); Wang, Q (Wang, Qi); Shao, DD (Shao, Dadong); Wang, XK (Wang, Xiangke)

Abstract

Polyacrylamide (PAM) grafted graphene oxide (denoted as PAM/GO) was synthesized by the plasma-induced polymerization technique and applied as an adsorbent for the simultaneous removal of radionuclides from radioactive wastewater. The interactions of PAM/GO with the radionuclides U(VI), Eu(III) and Co(II) were studied, along with their sorption kinetics. The results indicated that radionuclide sorption on PAM/GO was affected by the solution pH and ionic strength. The maximum sorption capacities of U(VI), Eu(III) and Co(II) on PAM/GO (0.698, 1.245 and 1.621 mmol g(-1), respectively) at pH = 5.0 +/- 0.1 and T = 295 K were much higher than those of radionuclides on GO and other adsorbents. The thermodynamic data (Delta H, Delta S and Delta G(0)) calculated from the temperature-dependent sorption isotherms suggested that the sorption of radionuclides on PAM/GO was a spontaneous and endothermic process. These results indicate that PAM/GO is a promising material for the control of radionuclide pollution.

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Faculty Name: Faculty of Engineering
DSR No.: 8402
Preparation of montmorillonite@carbon composite and its application for U(VI) removal from aqueous solution

Zhang, R (Zhang, Rui); Chen, CL (Chen, Changlun); Li, J (Li, Jie); Wang, XK (Wang, Xiangke)

Abstract

The montmorillonite@carbon (MMT@C) composite was synthesized by the one-step hydrothermal carbonization process. U(VI) sorption on MMT@C from aqueous solution was investigated by using batch experiments. The maximum capacity of MMT@C toward U(VI) was 20.76 mg g(-1) at pH 3.95, which was much higher than that of the raw MMT. The decoration of the functional carbonaceous species on the MMT@C improved its sorption capacity. U(VI) sorption on the MMT@C was an endothermic process. The inner-sphere surface complexation might be the primary sorption mechanism. MMT@C was a promising material for pre-concentration and immobilization of U(VI) from large volumes of aqueous solution. (C) 2015 Elsevier B.V. All rights reserved.
44. Reconfigurable Coordination of Distributed Discrete Event Control Systems

Zhang, JF (Zhang, Jiafeng); Khalgui, M (Khalgui, Mohamed); Li, ZW (Li, Zhiwu); Frey, G (Frey, Georg); Mosbahi, O (Mosbahi, Olfa); Ben Salah, H (Ben Salah, Hela)

Abstract

Dynamic reconfigurability is receiving more and more attention from both academy and industry, which means the ability to flexibly modify system functions by adding/removing hardware/software components, modifying logic relation between components, or updating particular system data at runtime without sacrificing the system performance. A distributed reconfigurable discrete event control system (DRDECS) is composed of several networked reconfigurable subsystems. In order to realize system functions, these reconfigurable subsystems communicate and coordinate with each other, since any casually reconfiguration applied to a subsystem may cause risks to others, or even to the safety of the whole system. This brief proposes a new coordination method for a DRDECS, where each subsystem is modeled by a reconfigurable timed net condition/event system. A virtual coordinator together with a communication protocol between it and subsystems is developed in order to achieve two aims: 1) to coordinate subsystems with an optimal coordination solution using judgement matrices while multiple subsystems require global reconfigurations and 2) to reduce exchanged messages between the coordinator and these subsystems. Furthermore, for the purpose of checking functional and temporal properties of a DRDECS with this virtual coordinator, a computation tree logic-based model checking method is applied. Finally, a hypothetic manufacturing plant is used as a running example to illustrate this brief.
45. Reliable H-infinity filtering for stochastic spatial-temporal systems with sensor saturations and failures

Wang, D (Wang, Dong); Shen, B (Shen, Bo); Wang, ZD (Wang, Zidong); Alsaadi, FE (Alsaadi, Fuad Eid); Dobaie, AM (Dobaie, Abdullah M.)

Abstract

This study is concerned with the reliable H-infinity filtering problem for a class of stochastic spatial-temporal systems with sensor saturations and failures. Different from the continuous spatial-temporal systems, the dynamic behaviour of the system under consideration evolves in a discrete rectangular region. The aim of this study is to estimate the system states through the measurements received from a set of sensors located at some specified points. In order to cater for more realistic signal transmission process, the phenomena of sensor saturations and sensor failures are taken into account. By using the vector reorganisation approach, the spatial-temporal system is first transformed into an equivalent ordinary differential dynamic system. Then, a filter is constructed and a sufficient condition is obtained under which the filtering error dynamics is asymptotically stable in probability and the H-infinity performance requirement is met. On the basis of the analysis results, the desired reliable H-infinity filter is designed. Finally, an illustrative example is given to show the effectiveness of the proposed filtering scheme.

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46. Retina layer segmentation using kernel graph cuts and continuous max-flow

Kaba, D (Kaba, D.); Wang, Y (Wang, Y.); Wang, C (Wang, C.); Liu, X (Liu, X.); Zhu, H (Zhu, H.); Salazar-Gonzalez, AG (Salazar-Gonzalez, A. G.); Li, Y (Li, Y.)

Abstract

Circular scan Spectral-Domain Optic Coherence Tomography imaging (SD-OCT) is one of the best tools for diagnosis of retinal diseases. This technique provides more comprehensive detail of the retinal morphology and layers around the optic disc nerve head (ONH). Since manual labelling of the retinal layers can be tedious and time consuming, accurate and robust automated segmentation methods are needed to provide the thickness evaluation of these layers in retinal disorder assessments such as glaucoma. The proposed method serves this purpose by performing the segmentation of retinal layers boundaries in circular SD-OCT scans acquired around the ONH. The layers are detected by adapting a graph cut segmentation technique that includes a kernel-induced space and a continuous multiplier based max-flow algorithm. Results from scan images acquired with Spectralis (Heidelberg Engineering, Germany) prove that the proposed method is robust and efficient in detecting the retinal layers boundaries in images. With a mean root-mean-square error (RMSE) of 0.0835 +/- 0.0495 and an average Dice coefficient of 0.9468 +/- 0.0705 pixels for the retinal nerve fibre layer thickness, the proposed method demonstrated effective agreement with manual annotations. (C) 2015 Optical Society of America
47. **Shuffled Iterative Receiver for LDPC-Coded MIMO Systems**

Zhao, PY (Zhao, Peiyao); Qian, C (Qian, Chen); Wang, ZC (Wang, Zhaocheng); Dai, LL (Dai, Linglong); Chen, S (Chen, Sheng)

**Abstract**

In this paper, we consider the low density parity check (LDPC) coded multi-input multi-output (MIMO) system with iterative detection and decoding (IDD). Since the traditional frame-by-frame receiver scheme suffers from a huge decoding delay, we propose an efficient scheme with a shuffled structure between the demapper and decoder, which adopts group vertical shuffled belief propagation (BP) algorithm. The proposed shuffled iterative receiver converges faster and significantly reduces the delay introduced by the IDD process. Simulation results demonstrate that our proposed shuffled iterative receiver exhibits several tenths dB of signal-to-noise ratio gain in comparison to the existing schemes, while imposing a much lower average number of iterations for the IDD process.
48. Smart monitoring system with multi-criteria decision using a feature based computer vision technique

Lin, CW (Lin, Chih-Wei); Hsu, WK (Hsu, Wen-Ko); Chiou, DJ (Chiou, Dung-Jiang); Chen, CW (Chen, Cheng-Wu); Chiang, WL (Chiang, Wei-Ling)

Abstract

When natural disasters occur, including earthquakes, tsunamis, and debris flows, they are often accompanied by various types of damages such as the collapse of buildings, broken bridges and roads, and the destruction of natural scenery. Natural disaster detection and warning is an important issue which could help to reduce the incidence of serious damage to life and property as well as provide information for search and rescue afterwards. In this study, we propose a novel computer vision technique for debris flow detection which is feature-based that can be used to construct a debris flow event warning system. The landscape is composed of various elements, including trees, rocks, and buildings which are characterized by their features, shapes, positions, and colors. Unlike the traditional methods, our analysis relies on changes in the natural scenery which influence changes to the features. The "background module" and "monitoring module" procedures are designed and used to detect debris flows and construct an event warning system. The multi-criteria decision-making method used to construct an event warning system includes gradient information and the percentage of variation of the features. To prove the feasibility of the proposed method for detecting debris flows, some real cases of debris flows are analyzed. The natural environment is simulated and an event warning system is constructed to warn of debris flows. Debris flows are successfully detected using these two procedures, by analyzing the variation in the detected features and the matched feature. The feasibility of the event warning system is proven using the simulation method. Therefore, the feature based method is found to be useful for detecting debris flows and the event warning system is triggered when debris flows occur.

Sources

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49. Sparse Density Estimation on the Multinomial Manifold

Hong, X (Hong, Xia); Gao, JB (Gao, Junbin); Chen, S (Chen, Sheng); Zia, T (Zia, Tanveer)

Abstract

A new sparse kernel density estimator is introduced based on the minimum integrated square error criterion for the finite mixture model. Since the constraint on the mixing coefficients of the finite mixture model is on the multinomial manifold, we use the well-known Riemannian trust-region (RTR) algorithm for solving this problem. The first- and second-order Riemannian geometry of the multinomial manifold are derived and utilized in the RTR algorithm. Numerical examples are employed to demonstrate that the proposed approach is effective in constructing sparse kernel density estimators with an accuracy competitive with those of existing kernel density estimators.
50. Successive lag synchronization on nonlinear dynamical networks via linear feedback control

Li, KZ (Li, Kezan); Yu, WW (Yu, Wenwu); Ding, Y (Ding, Yong)

Abstract

Successive lag synchronization (SLS) is defined as a new synchronization pattern, which means that lag synchronization appears between two successively numbered nodes in a dynamical network. Based on the topological structure of the considered network, linear feedback control and adaptive linear feedback control are proposed to achieve the SLS. By using Lyapunov function method and Barbalat Lemma, some sufficient conditions for the global stability of SLS are obtained. Moreover, the stability condition is independent on time delay. By using the proposed control method, successive lag consensus of a multi-agent system with second-order dynamics is also realized. By utilizing the Chua's circuit as the local nonlinear dynamics of all nodes in the network, several numerical examples are presented to verify the theoretical results.
51. Superior adsorption capacity of \textsuperscript{g}-C\textsubscript{3}N\textsubscript{4} for heavy metal ions from aqueous solutions

Shen, CC (Shen, Congcong); Chen, CL (Chen, Changlun); Wen, T (Wen, Tao); Zhao, ZW (Zhao, Zhiwei); Wang, XK (Wang, Xiangke); Xu, AW (Xu, Anwu)

Abstract

In this work, graphitic-C\textsubscript{3}N\textsubscript{4} (g-C\textsubscript{3}N\textsubscript{4}) was synthesized by a simple and environmentally friendly salt melt method, and characterized by using field-emission scanning and transmission electron microscopy, X-ray diffraction, Fourier transformed infrared spectroscopy, X-ray photoelectron spectroscopy and N\textsubscript{2} adsorption-desorption analysis. The as-prepared g-C\textsubscript{3}N\textsubscript{4} was used as an adsorbent to remove heavy metal ions from aqueous solutions. The adsorption kinetics of Pb(II) and Cu(II) followed the pseudo-second-order model. The g-C\textsubscript{3}N\textsubscript{4} exhibited much higher adsorption capacity toward heavy metal ions (1.36 mmol/g for Pb(II), 2.09 mmol/g for Cu(II), 1.00 mmol/g for Cd(II) and 0.64 mmol/g for Ni(II)) than other adsorbents. The adsorption of Pb(II) and Cu(II) on g-C\textsubscript{3}N\textsubscript{4} was slightly affected by ionic strength at pH < 5.0 and increased with the increase of ionic strength at pH > 5.0. The inner-sphere surface complexation mechanism was suitable to explain the interaction between heavy metal ions and the nitrogen- and carbon-containing functional groups of the g-C\textsubscript{3}N\textsubscript{4}. The experimental results reveal that g-C\textsubscript{3}N\textsubscript{4} is a potential adsorbent for the removal of heavy metal ions from large volumes of aqueous solutions. (C) 2015 Elsevier Inc. All rights reserved.
Support Vector Machine for Day Ahead Electricity Price Forecasting

Razak, IABWA (Razak, Intan Azmira Binti Wan Abdul); Abidin, IB (Abidin, Izham Bin Zainal); Siah, YK (Siah, Yap Keem); Rahman, TKBA (Rahman, Titik Khawa Binti Abdul); Lada, MY (Lada, M. Y.); Ramani, ANB (Ramani, Anis Niza Binti); Nasir, MNM (Nasir, M. N. M)

Abstract

Electricity price forecasting has become an important part of power system operation and planning. In a pool-based electric energy market, producers submit selling bids consisting in energy blocks and their corresponding minimum selling prices to the market operator. Meanwhile, consumers submit buying bids consisting in energy blocks and their corresponding maximum buying prices to the market operator. Hence, both producers and consumers use day ahead price forecasts to derive their respective bidding strategies to the electricity market yet reduce the cost of electricity. However, forecasting electricity prices is a complex task because price series is a non-stationary and highly volatile series. Many factors cause for price spikes such as volatility in load and fuel price as well as power import to and export from outside the market through long term contract. This paper introduces an approach of machine learning algorithm for day ahead electricity price forecasting with Least Square Support Vector Machine (LS-SVM). Previous day data of Hourly Ontario Electricity Price (HOEP), generation’s price and demand from Ontario power market are used as the inputs for training data. The simulation is held using LSSVMlab in Matlab with the training and testing data of 2004. SVM that widely used for classification and regression has great generalization ability with structured risk minimization principle rather than empirical risk minimization. Moreover, same parameter settings in trained SVM give same results that absolutely reduce simulation process compared to other techniques such as neural network and time series. The mean absolute percentage error (MAPE) for the proposed model shows that SVM performs well compared to neural network.
Surface functionalization graphene oxide by polydopamine for high affinity of radionuclides

Zhao, ZW (Zhao, Zhiwei); Li, JX (Li, Jiaxing); Wen, T (Wen, Tao); Shen, CC (Shen, Chongchong); Wang, XK (Wang, Xiangke); Xu, AW (Xu, Anwu)

Abstract

The utilization of nuclear energy plays an important role in our energy system; however, the leaking of radionuclides has potential threat to human health. In this paper, two-dimensional polydopamine/graphene oxide (PD/GO) composites were synthesized through a simple bio-inspired surface functionalization process by self-polymerization of dopamine monomers on GO surface. To evaluate the adsorption performance of PD/GO composites, the adsorbent was applied to remove uranium(VI) from aqueous solutions. Based on the Langmuir's equation, the maximum adsorption capacity was calculated to be 145.39 mg.g(-1) by PD/GO composites, which is higher than that of pure PD (34.21 mg.g(-1)) and GO (75.71 mg.g(-1)). The enhanced adsorption capacity was mainly ascribed to the synergistic effect of PD with multifunctional groups and GO with high surface area. The adsorption process fitted well with the Langmuir adsorption isotherm and a pseudo-second order kinetics. Moreover, adsorption and regeneration experiment proved the samples can support long-term use in nuclear waste management. This work provides a convenient and promising materials for the removal of U(VI) from polluted water.

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54. Synthesis and lithium-storage properties of MnO/reduced graphene oxide composites derived from graphene oxide plus the transformation of Mn(VI) to Mn(II) by the reducing power of graphene oxide

Zhao, GX (Zhao, Guixia); Huang, XB (Huang, Xiubing); Wang, XK (Wang, Xiangke); Connor, P (Connor, Paul); Li, JX (Li, Jiaxing); Zhang, SW (Zhang, Shouwei); Irvine, JTS (Irvine, John T. S.)

Abstract

In this report, a novel method is proposed to prepare MnO/reduced graphene oxide (rGO) composites via calcining the precursors (i.e. d-MnO2/graphene oxide composites) at 500 degrees C in Ar using no external reducing gas, in which graphene oxide (GO) successfully serves as a reductant by releasing CO during its thermolysis for the first time. By controlling the initial ratios of GO to KMnO4, differently composed precursors can be obtained via the redox reaction between GO and KMnO4, then leading to the formation of composites with different MnO/rGO ratios and dispersion of MnO on the rGO surface (denoted as MGC1 and MGC2). When applied as an active material in lithium ion batteries, MGC1 shows excellent cycling performance and capacity retention. Under 100 and 200 mA g(-1), MGC1 could deliver reversible capacities as high as 900 and 750 mA h g(-1), respectively, after more than 100 cycles. Considering the simple operation and low energy consumption in the whole material synthesis processes, the present strategy is feasible and effective for practical application. Even more importantly, the reductibility of graphene oxide upon thermolysis is utilized for the first time, which is meaningful for its extension in synthesis of functional nanomaterials.

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The artificial neural network for solar radiation prediction and designing solar systems: a systematic literature review

Qazi, A (Qazi, Atika); Fayaz, H (Fayaz, H.); Wadi, A (Wadi, A.); Raj, RG (Raj, Ram Gopal); Rahim, NA (Rahim, N. A.); Khan, WA (Khan, Waleed Ahmed)

Abstract

Solar energy generated by sunlight has a non-schedulable nature due to the stochastic environment of meteorological conditions. Hence, power system control and the energy business require the prediction of solar energy (radiation) from a few seconds up to one week in advance. To deal with prediction shortcomings, various solar radiation prediction methods have been used. Predictive data mining offers variety of methods for solar radiation predictions where artificial neural network is one of the reliable and accurate methods. A systematic review of literature was conducted and identified 24 papers that discuss artificial neural network for solar systems design and solar radiation prediction. The artificial neural network techniques were employed for designing solar systems and predicting solar radiations to assess current literature on the basis of prediction accuracy and inadequacies. Specific inclusion and exclusion criteria in two distinct rounds were applied to determine the most relevant studies for our research goal. Further, it is observed from the result of this study that artificial neural network gives good accuracy in terms of prediction error less than 20%. The accuracy of solar radiation prediction models is found to be dependent on input parameters and architecture type algorithms utilized. Therefore, artificial neural network as compared to other empirical models is capable to deal with many input meteorological parameters, which make it more accurate and reliable. (C) 2015 Elsevier Ltd. All rights reserved.
The Effects of Single-Level Instrumented Lumbar Laminectomy on Adjacent Spinal Biomechanics

Bisschop, A (Bisschop, Arno); Holewijn, RM (Holewijn, Roderick M.); Kingma, I (Kingma, Idsart); Stadhouder, A (Stadhouder, Agnita); Vergroesen, PPA (Vergroesen, Pieter-Paul A.); van der Veen, AJ (van der Veen, Albert J.); van Dieen, JH (van Dieen, Jaap H.

Abstract

Study Design Biomechanical study. Objective Posterior instrumentation is used to stabilize the spine after a lumbar laminectomy. However, the effects on the adjacent segmental stability are unknown. Therefore, we studied the range of motion (ROM) and stiffness of treated lumbar spinal segments and cranial segments after a laminectomy and after posterior instrumentation in flexion and extension (FE), lateral bending (LB), and axial rotation (AR). These outcomes might help to better understand adjacent segment disease (ASD), which is reported cranial to the level on which posterior instrumentation is applied. Methods We obtained 12 cadaveric human lumbar spines. Spines were axially loaded with 250 N for 1 hour. Thereafter, 10 consecutive load cycles (4 Nm) were applied in FE, LB, and AR. Subsequently, a laminectomy was performed either at L2 or at L4. Thereafter, load-deformation tests were repeated, after similar preloading. Finally, posterior instrumentation was added to the level treated with a laminectomy before testing was repeated. The ROM and stiffness of the treated, the cranial adjacent, and the control segments were calculated from the load-displacement data. Repeated-measures analyses of variance used the spinal level as the between-subject factor and a laminectomy or instrumentation as the within-subject factors. Results After the laminectomy, the ROM increased (+19.4%) and the stiffness decreased (-18.0%) in AR. The ROM in AR of the adjacent segments also increased (+11.0%). The ROM of treated segments after instrumentation decreased in FE (-74.3%), LB (-71.6%), and AR (-59.8%). In the adjacent segments after instrumentation, only the ROM in LB was changed (-12.9%). Conclusions The present findings do not substantiate a biomechanical pathway toward or explanation for ASD.
57. **Uptake of Pb(II) and U(VI) ions from aqueous solutions by the ZSM-5 zeolite**

Wang, XX (Wang, Xiangxue); Shao, DD (Shao, Dadong); Hou, GS (Hou, Guangshun); Wang, XK (Wang, Xiangke); Alsaedi, A (Alsaedi, Ahmed); Ahmad, B (Ahmad, Bashir)

**Abstract**

The ZSM-5 zeolite was characterized by powder X-ray diffraction (XRD) and Fourier transformed infrared (FT-IR) spectroscopy, and has the characteristics of pure zeolites. The application of the ZSM-5 zeolite as an adsorbent to remove Pb(II) and U(VI) from aqueous solutions was studied with the maximum adsorption capacities of 20.1 mg/g for Pb(II) and 37.6 mg/g for U(VI) at pH 3.0 and 0.010 mol/L NaNO₃, respectively. The uptakes of Pb(II) and U(VI) from aqueous solutions are strongly dependent on pH and weakly dependent on ionic strength, and reach equilibrium within 4 h of contact time at T = 25 +/- 2 degrees C. The adsorption processes can be well described by the pseudo-second-order rate equation and classical Langmuir model. Experimental results exhibited a potential application of the ZSM-5 zeolite in Pb(II) and U(VI) pollution cleanup. (C) 2015 Elsevier B.V. All rights reserved.
58. Verification of Current-State Opacity Using Petri Nets

Tong, Y (Tong, Yin); Li, ZW (Li, Zhiwu); Seatzu, C (Seatzu, Carla); Giua, A (Giua, Alessandro)

Abstract

This paper addresses the problem of current-state opacity of discrete event systems (DES) modeled with Petri nets. A system is said to be current-state opaque if the intruder who only has partial observations on the system's behavior is never able to infer that the current state of the system is within a set of secret states. Based on the notion of basis markings, an efficient approach to verifying current-state opacity in bounded Petri nets is proposed, without computing the whole reachability set or exhaustively enumerating the set of markings consistent with the observation. An example showing the efficiency of the approach is presented.

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Tong, Y (reprint author), Xidian Univ, Sch Electromech Engn, Xian 710071, Peoples R China.

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Automation & Control Systems; Engineering

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No Department

DSR No. :
7501
1. A FAULT TOLERANT DIRECT CONTROL ALLOCATION SCHEME WITH INTEGRAL SLIDING MODES

Hamayun, MT (Hamayun, Mirza Tariq); Edwards, C (Edwards, Christopher); Alwi, H (Alwi, Halim); Bajodah, A (Bajodah, Abdulrahman)

Abstract

In this paper, integral sliding mode control ideas are combined with direct control allocation in order to create a fault tolerant control scheme. Traditional integral sliding mode control can directly handle actuator faults; however, it cannot do so with actuator failures. Therefore, a mechanism needs to be adopted to distribute the control effort amongst the remaining functioning actuators in cases of faults or failures, so that an acceptable level of closed-loop performance can be retained. This paper considers the possibility of introducing fault tolerance even if fault or failure information is not provided to the control strategy. To demonstrate the efficacy of the proposed scheme, a high fidelity nonlinear model of a large civil aircraft is considered in the simulations in the presence of wind, gusts and sensor noise.
2. A new paradigm for star grain design and optimization

Rafique, AF (Rafique, Amer F.); Zeeshan, Q (Zeeshan, Qasim); Kamran, A (Kamran, Ali); Liang, GZ (Liang Guozhu)

Abstract

Purpose - The paper aims to extend the knowledge base for design and optimization of Star grain which is well known for its simplicity, reliability and efficiency. Star grain configuration is considered to be among the extensively used configurations for the past 60 years. The unexplored areas of treatment of ballistic constraints, non-neutral trace and freedom from use of generalized design equations and sensitivity analysis of optimum design point are treated in detail to bridge the gap. The foremost purpose is to expand the design domain by considering entire convex Star family under both neutral and non-neutral conditions.

Design/methodology/approach - This research effort optimizes Star grain configuration for use in Solid Rocket Motors with ballistic objective function (effective total impulse) and parametric modelling of the entire convex Star grain family using solid modelling module. Internal ballistics calculations are performed using equilibrium pressure method. Optimization process consists of Latinized hypercube generated initial population and Swarm Intelligence optimizer's ability to search design space. Candidate solutions are passed to solid modelling module to simulate the burning process. Optimal design points, critical geometrical and important ballistic parameters (throat diameter, burn rate, characteristic velocity and propellant density) are then tested for sensitivities through Monte Carlo simulation.

Findings - The proposed approach takes the design of Star grain configuration to a new level with introduction of parametric modelling and sensitivity analysis, thus, offering practical optimum design points for use in various mission scenarios. The proposed design and optimization process provides essential data sets which can be useful prior to the production of large number of solid rocket motors. Results also advocate the adequacy of design from engineering perspective and practicality.

Research limitations/implications - Results showed that few design parameters are sensitive to uncertainties. These uncertainties can be investigated in future by a robust design method.

Practical implications - Monte Carlo simulation can prove to be vital considering the production of a large number of motor units and enlightens the necessity to obtain statistical data during manufacturing.

Originality/value - This paper fulfils long-sought requirement on getting free from use of generalized set of equations for commonly used Star grain configurations.

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Cited reference count : 29
Language : English
Document Type : Article
Reprint Address : Rafique, AF (reprint author), King Abdulaziz Univ, Ctr Excellence Intelligent Engn Syst, Dept Aeronaut Engn, Jeddah, Saudi Arabia.
3. An Experimental Investigation of Turbulent Convection Velocities in a Turbulent Boundary Layer

Atkinson, C (Atkinson, Callum); Buchmann, NA (Buchmann, Nicolas Alexander); Soria, J (Soria, Julio)

Abstract

Turbulent convection velocities in a turbulent boundary layer at a Reynolds number of Re-theta = 2250 are examined via the use of a high repetition rate particle image velocimetry measurement undertaken in a water tunnel. Multiple cameras are used to improve the spatial dynamic range of the measurement and reduce the bias towards large-scale structures while simultaneously capturing a wall-normal domain of 0.06 delta to 1.7 delta. The impact of measurement noise is minimized via careful temporal and spatial filtering of the velocity fields as guided by the comparison of temporal and spatial velocity power spectra with spatially filtered direct numerical simulation data, enabling an estimation of the effective noise-limited spatial and temporal dynamic range of the present experimental measurement. Space-time correlations and phase-spectra are used to estimate the mean and streamwise wave-number dependent convection velocities at various heights above the wall. Results reveal convection velocities greater than the local mean velocity in the lower log layer, decreasing to a level 3.5% lower than the mean velocity in the upper log and wake regions. The convection velocity is shown to depend on the streamwise length scale and is found to decrease at higher wave-numbers for all wall-normal locations. Comparison between the measured and reconstructed spatial fields show that Taylor’s hypothesis can only be applied over short streamwise distances of less than 1 delta in the buffer and inner log-layer, while larger projection distances (>= 3 delta) are possible in the outer-log and wake region of the turbulent boundary layer.
4. Analytical and experimental investigation of tensile properties of cross-ply and angle-ply GFRP composite laminates

Bourchak, M (Bourchak, Mostefa); Harasani, W (Harasani, Wail)

Abstract

The static tensile properties in the form of ultimate failure stress, ultimate failure strain and Young's modulus of a cross-ply glass fiber-reinforced polymer (GFRP) composite laminate [90(4), 0(4)](s) and an unconventional angle-ply GFRP composite laminate [+67.5(4), -67.5(4)](s) were investigated using the netting analysis, the laminate mixture rule (Hart-Smith 10% rule) and the classical laminate theory (CLT). The findings were then compared to experimental results to determine the accuracy of each analytical technique. It was found that the netting analysis was the best overall method for estimating the cross-ply laminate tensile properties, whereas neither the CLT nor the 10% rule were appropriate for estimating the tensile properties of the unconventional ply angle laminate.

Sources:
SCIENCE AND ENGINEERING OF COMPOSITE MATERIALS

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Publisher: WALTER DE GRUYTER GMBH
Web of Science Categories: Materials Science, Composites
Research Areas: Materials Science
Faculty Name: Faculty of Engineering
Department Name: Aeronautical Engineering
DSR No.: 6416
5. Application of a single-board computer as a low-cost pulse generator

Fedrizzi, M (Fedrizzi, Marcus); Soria, J (Soria, Julio)

Abstract

A BeagleBone Black (BBB) single-board open-source computer was implemented as a low-cost fully programmable pulse generator. The pulse generator makes use of the BBB Programmable Real-Time Unit (PRU) subsystem to achieve a deterministic temporal resolution of 5 ns, an RMS jitter of 290 ps and a timebase stability on the order of 10 ppm. A Python-based software framework has also been developed to simplify the usage of the pulse generator.
6. ASSESSMENT OF LIQUID RESIN INFUSION IMPREGNATION QUALITY USING SCANNING ELECTRON MICROSCOPY

Bourchak, M (Bourchak, Mostefa); Harasani, W (Harasani, Wail)

Abstract

Fibre reinforced composite materials are increasingly becoming the popular choice of materials for designers in many fields such as aircraft manufacturing. As well as the accompanying high costs, one of their main limitations is the difficulty of making shaped parts such as those of aircraft and UAVs. To overcome this problem, various composite manufacturing techniques have been developed including the vacuum resin infusion (VRI) process and its many derivatives. In this work, a cross ply glass fibre reinforced plastic (GFRP) composite laminate was manufactured using liquid resin infusion (LRI) process which is a derivative of VRI. Specimens cut from the manufactured laminate are tested under static tensile loading and then investigated for resin impregnation quality using two types of state of the art Field Emission Scanning Electron Microscopes (FESEM). Images taken showed some plies with well intralaminar (inter fibre within single ply) impregnation whereas in some locations - within mainly the internal plies - there was very little impregnation. The implication is that unidirectional (UD) laminated when stacked in a cross ply form present another LRI process factor that is not widely investigated. Consequently, infusing UD cross ply composite laminates may present more challenges compared to infusing woven fabrics which are helped by the gaps between the fibres weave and weft.

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Publisher: ADCOTEC LTD
Web of Science Categories: Materials Science, Composites
Research Areas: Materials Science
Faculty Name: Faculty of Engineering
Department Name: Aeronautical Engineering
DSR No.: 7653
7. **Combustion characteristics of the effect of hydrogen addition on LPG-air mixtures**

Aravind, B (Aravind, B.); Kishore, VR (Kishore, Velamati Ratna); Mohammad, A (Mohammad, Akram)

**Abstract**

The present study reports the effect of hydrogen addition on combustion characteristics of LPG air mixtures for different mixture compositions, temperatures and pressures. Numerical simulation has been carried out using USC Mech II reaction mechanism, consisting of 111 species and 784 reactions. It is found that, variation of the flame speeds were relatively small for various compositions of LPG air mixtures used. Thus 50% propane 50% butane mixture is considered for the present work. The effect of volumetric H-2 addition on laminar flame speed and ignition delay of selected LPG (50% propane + 50% butane) air mixtures is then studied for hydrogen addition ratio varying from 0 < R-H < 0.5 and over a wide range of mixture equivalence ratio. Also, the investigation is carried out for mixture temperature up to 450 K and pressure ranging from 1 to 10 bar. A parabolic variation of laminar flame speed is observed with equivalence ratios giving peak value for slightly rich mixture. A linear correlation has been observed for the flame speed as a function of hydrogen addition, R-H at all the conditions studied. Whereas, power law correlation has been proposed for the hydrogen added LPG air mixture, to understand the dependency of laminar flame speed on temperature and pressure. A generic correlation has been proposed to study the combined effect of temperature and pressure on laminar flame speed. Copyright (C) 2015, Hydrogen Energy Publications, LLC. Published by Elsevier Ltd. All rights reserved.

**Sources**

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Web of Science Categories: Chemistry, Physical; Electrochemistry; Energy & Fuels

Research Areas: Chemistry; Electrochemistry; Energy & Fuels

Faculty Name: Faculty of Engineering

Department Name: Aeronautical Engineering

DSR No.: 4234
8. Concept design of a PGNAA system for optimizing the performance of gravity separators

Al-Bahi, AM (Al-Bahi, Ali M.); Soliman, AYA (Soliman, Abdelfattah Y. A.); Alzahrani, A (Alzahrani, Abdulrahim); Abdelhady, F (Abdelhady, Faisal); Mohamed, NMA (Mohamed, Nader M. A.)

Abstract

A detection system for the determination of the level of different layers inside the oil gravity separators is presented. The system is based on prompt gamma neutron activation analysis using D-T neutron source. The performance of the system proved to be superior to current and potential nuclear counting techniques proposed in the literature for the same purpose including neutron backscattering, gamma backscattering, and gamma transmission. According to the concept design calculations using the Monte Carlo method, the proposed system detects the levels of different layers with high accuracy. This concept design is the first stage of the research project entitled "design of an instrument for measurement of oil, water, vapour and sand layers in oil separators using neutrons" supported by King Abdulaziz University.
9. Dynamic stall in vertical axis wind turbines: Comparing experiments and computations

Buchner, AJ (Buchner, A-J.); Lohry, MW (Lohry, M. W.); Martinelli, L (Martinelli, L.); Soria, J (Soria, J.); Smits, AJ (Smits, A. J.)

Abstract

Dynamic stall is often found in unsteady aerodynamic flows where the angle of attack can vary over a large range. It is of particular interest in the context of vertical axis wind turbines, where dynamic stall is the principal impediment to achieving improved aerodynamic efficiency. Here, we report computations using the unsteady Reynolds-averaged Navier-Stokes (URANS) equations with the Menter-SST turbulence model on a two-dimensional domain, over a range of tip speed ratios typical of the operation of vertical axis wind turbines. Comparisons are made against high resolution experimental data from particle image velocimetry (Ply), with special attention to the ability of the turbulence model to emulate the turbulence properties of the flow. It is shown that the computations approximate the experimental results well in most respects. (C) 2015 Elsevier Ltd. All rights reserved.
10. Large Eddy Simulation of Flow Past Tandem Cylinders in a Channel

AlQadi, I (AlQadi, Ibraheem); AlHazmy, M (AlHazmy, Majed); Al-Bahi, A (Al-Bahi, Ali); Rodi, W (Rodi, Wolfgang)

Abstract

The paper presents Large Eddy Simulation (LES) of flow around two circular cylinders in tandem placed in an open channel. This and the closely related situation of tandem cylinders in a passage are rich of complex flow phenomena and of considerable practical and fundamental interest. The configuration was set up to correspond closely to an experiment (Ataie-Ashtiani and Aslani-Kordkandi Flow Turbul. Combust. 90(3), 471-490 (2013)) with detailed velocity measurements. The ratio of the distance between the cylinders, \( L \), and the cylinder diameter, \( D \), and the ratio of water depth \( h \) to \( D \), are \( L/D=3 \) and \( h/D=3.1 \), respectively, as in the experiment. However, a lower Reynolds number had to be used and a smooth channel wall instead of a somewhat rough wall in the experiments. The Reynolds numbers based on channel height and cylinder diameter are 22,600 and 7,300 respectively. A fine grid was employed so that the LES is well resolved and the results are little affected by the subgrid-scale model (dynamic Smagorinsky) and represent well the actual physical processes of the situation studied. A comparison with experimental results of mean flow, turbulence quantities and shedding frequency shows that there is good agreement about all the main features, but there are some quantitative differences as the flow situations differed in some respects. The complex 3D flow behaviour is analyzed and described with the aid of the LES results, and these also provide benchmark data for testing other, less costly calculation methods which are preferred in practice.
11. Luminescence Properties of CaF2 Nanostructure Activated by Different Elements

Salah, N (Salah, Numan); Alharbi, ND (Alharbi, Najlaa D.); Habib, SS (Habib, Sami S.); Lochab, SP (Lochab, S. P.)

Abstract

Nanostructures of calcium fluoride (CaF2) doped with Eu, Tb, Dy, Cu, and Ag were synthesized by the coprecipitation method and studied for their thermoluminescence (TL) and photoluminescence (PL) properties. The PL emission spectrum of pure CaF2 nanostructure has a broad band in the 370-550nm range. Similar spectra were observed in case of doped samples, beside extra bands related to these impurities. The maximum PL intensity was observed in Eu doped sample. The TL results of Eu, Cu, Ag, and Tb doped samples show weak glow peaks below 125 degrees C, whereas Dy doped one is found to be highly sensitive with a prominent peak at 165 degrees C. This sample was further exposed to a wide range of gamma rays exposures from Cs-137 source. The response curve is linear in the 100 Gy-10 kGy range. It is also observed that the particle size of CaF2 nanostructure was significantly reduced by increasing Dy concentration. These results showed that Dy is a proper activator in the host of CaF2 nanostructure, providing a highly sensitive dosimeter in a wide range of exposures and also plays a role as a controlling agent for particle size growth.

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Web of Science Categories: Nanoscience & Nanotechnology; Materials Science, Multidisciplinary
Research Areas: Science & Technology - Other Topics; Materials Science
Faculty Name: Faculty of Engineering
Department Name: Aeronautical Engineering
DSR No.: 8226
12. Measurements of the flow due to a rapidly pitching plate using time resolved high resolution PIV

Buchner, AJ (Buchner, A-J.); Soria, J (Soria, J.)

Abstract

The flow topology arising from unsteady airfoil motion is complex, but the benefits of understanding such flows extend to a wide variety of applications. Natural flows such as those induced by birds or insects during flapping flight, or by the rapidly moving fins of swimming fish, as well as flows over the manoeuvring wings of micro air vehicles (MAVs) or the rotors of helicopters or wind turbines exhibit behaviours typical of rapidly manoeuvring airfoils. This paper presents measurements and discussion on a set of recent experiments performed on a rapidly pitching plate in low Reynolds number flow. Time resolved particle image velocimetry (PIV) data with a high spatio-temporal resolution are presented, and the main features of the flow are identified. Measurements are taken at six Reynolds numbers ranging between 1500 and 10000 and an analysis is given of the temporal evolution of the massively separated flow at the leading edge as well as at the trailing edge and in the wake. Individual coherent structures are located and tracked, and the variation of their strength and fluctuation are quantified as a function of time. Several key observations are made regarding the effect of Reynolds number on the topology of the wake structure of a pitching flat plate. (C) 2014 Elsevier Masson SAS. All rights reserved.
13. **Numerical simulation of surface porosity in presence of wing-vortex interaction**

Eljack, E (Eljack, Elteyeb); AlQadi, I (AlQadi, Ibraheem); Khalid, M (Khalid, Mahmood)

**Abstract**

Purpose - The purpose of this paper is to identifying ways to reduce the effects of wing-vortex interaction by applying surface porosity on selected areas of the exposed surface. A number of papers recently have investigated the aerodynamic implication of free-stream vortices impinging upon airfoils. Design/methodology/approach - The free-stream disturbance in these studies were represented by planting a vortex ahead of the wing or using some other disturbance invoking mechanism like von-Karman vortices in the wake of a cylinder or using a flipping plate to invoke a discrete vortex. In the present work, a well-defined method was used to germinate a system of controlled vortices of known strength, size and frequency ahead of the wing, and the impact of the subsequent interaction was studied with and without the presence of the surface porosity. The simulations tackled a number of cases when porosities of up to 20 and 22 per cent were applied to selected regions near the leading edge, with vortices of controlled strengths directed at the wing surface. Findings - The results showed that the effects of large vortices spanning the entire lengths of the wing can indeed be damped when porosity is selectively applied at strategic regions. Practical implications - Surface porosity application at strategic regions of a wing may dampen the effects of the unsteadiness of the incoming flow. This has profound implications on flight safety and structural damage prevention. Further implications could possibly be extended to UAV and wind turbines that operate at heavy gusting environment. Originality/value - Implementation of this particular method resolves some of the issues arisen when an airplane encounters atmospheric turbulence.
On the role of pressure in elasto-inertial turbulence

Terrapon, VE (Terrapon, Vincent E.); Dubief, Y (Dubief, Yves); Soria, J (Soria, Julio)

Abstract

The dynamics of elasto-inertial turbulence is investigated numerically from the perspective of the coupling between polymer dynamics and flow structures. In particular, direct numerical simulations of channel flow with Reynolds numbers ranging from 1000 to 6000 are used to study the formation and dynamics of elastic instabilities and their effects on the flow. Based on the splitting of the pressure into inertial and polymeric contributions, it is shown that the polymeric pressure is a non-negligible component of the total pressure fluctuations, although the rapid inertial part dominates. Unlike Newtonian flows, the slow inertial part is almost negligible in elasto-inertial turbulence. Statistics on the different terms of the Reynolds stress transport equation also illustrate the energy transfers between polymers and turbulence and the redistributive role of pressure. Finally, the trains of cylindrical structures around sheets of high polymer extension that are characteristics of elasto-inertial turbulence are shown to be correlated with the polymeric pressure fluctuations.
15. **Optimum design of a PID controller for the adaptive torsion wing**

Bourchak, M (Bourchak, M.); Ajaj, RM (Ajaj, R. M.); Flores, EIS (Flores, E. I. Saavedra); Khalid, M (Khalid, M.); Juhany, KA (Juhany, K. A.)

**Abstract**

This paper presents the optimum design of a PID controller for the Adaptive Torsion Wing (ATW) using the genetic algorithm (GA) optimiser. The ATW is a thin-wall, two-spar wingbox whose torsional stiffness can be adjusted by translating the spar webs in the chordwise direction inward and towards each. The reduction in torsional stiffness allows external aerodynamic loads to deform the wing and maintain its shape. The ATW is integrated within the wing of a representative UAV to replace conventional ailerons and provide roll control. The ATW is modelled as a two-dimensional equivalent aerofoil using bending and torsion shape functions to express the equations of motion in terms of the twist angle and plunge displacement at the wingtip. The full equations of motion for the ATW equivalent aerofoil were derived using Lagrangian mechanics. The aerodynamic lift and moment acting on the aerofoil were modelled using Theodorsen's unsteady aerodynamic theory. The equations of motion are then linearised around an equilibrium position and the GA is employed to design a PID controller for the linearised system to minimise the actuation power require. Finally, the sizing and selection of a suitable actuator is performed.

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**Web of Science Categories**: Engineering, Aerospace

**Research Areas**: Engineering

**Faculty Name**: Faculty of Engineering

**Department Name**: Aeronautical Engineering

**DSR No.**: 5832
16. Proposed stochastic parameterisations of subgrid turbulence in large eddy simulations of turbulent channel flow

Kitsios, V (Kitsios, V.); Sillero, JA (Sillero, J. A.); Frederiksen, JS (Frederiksen, J. S.); Soria, J (Soria, J.)

Abstract

Stochastic and deterministic subgrid parameterisations are developed for the large eddy simulation (LES) of a turbulent channel flow with friction-velocity-based Reynolds number of Re-\(\varepsilon\) = 950 and centreline-based Reynolds number of Re-0 = 20,580. The subgrid model coefficients (eddy viscosities) are determined from the statistics of truncated reference direct numerical simulations (DNSs). The stochastic subgrid model consists of a mean-field shift, a drain eddy viscosity acting on the resolved field and a stochastic backscatter force of variance proportional to the backscatter eddy viscosity. The deterministic variant consists of a net eddy viscosity acting on the resolved field, which represents the net effect of the drain and backscatter. LES adopting the stochastic and deterministic models is shown to reproduce the time-averaged kinetic energy spectra of the DNS within the resolved scales.

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Web of Science Categories : Mechanics; Physics, Fluids & Plasmas
Research Areas : Mechanics; Physics
Faculty Name : Faculty of Engineering
Department Name: Aeronautical Engineering
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126
17. Twist Morphing Using the Variable Cross Section Spar: Feasibility Study

Ajaj, RM (Ajaj, R. M.); Bourchak, M (Bourchak, M.); Harasani, W (Harasani, W.)

Abstract

This paper presents the variable cross section spar (VCSpar) concept that facilitates varying the shear center position relative to the aerodynamic center, allowing the external aerodynamic loads to twist the structure and maintain its deformed shape. The VCSpar is considered in this paper as integrated within the wing of a representative unmanned aerial vehicle (UAV) to enhance its flight performance and control authority. A preliminary design study was conducted to assess the potential benefits of the concept using a low-fidelity design tool. Then, aeroelastic modeling of the concept was performed where the VCSpar was modeled as a two-dimensional equivalent aerofoil using bending and torsion shape functions to express the equations of motion in terms of the twist angle and plunge displacement at the wingtip. The aerodynamic lift and moment acting on the equivalent aerofoil were modeled using Theodorsen’s unsteady aerodynamic theory. A low-dimensional state-space representation of an empirical Theodorsen’s transfer function was adopted to allow time-domain analyses. (C) 2014 American Society of Civil Engineers.

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Web of Science Categories: Engineering, Aerospace; Engineering, Civil
Research Areas: Engineering
Faculty Name: Faculty of Engineering
Department Name: Aeronautical Engineering
DSR No. : 4788
18. Two-channel pitch/yaw missile autopilot design using arbitrary order sliding modes based pole placement

Kada, B (Kada, B.)

Abstract

The paper presents a new missile autopilot system design. The design is achieved through the pole-placement in quasi-continuous high-order sliding mode gains adjustment. Enhanced performance, strong robustness and smooth control are obtained through arbitrary increase of the number of non-oscillatory stable poles. The target application of this technique the two-channel pitch/yaw missile autopilot system is considered. Numerical simulations indicate that the arbitrary-order sliding modes based pole placement’s performance compares favourably against recently proposed high-order pole placement schemes. The proposed arbitrary-order pole placement scheme presents a promising design tool for finite-time stabilisation and control of uncertain multivariable systems.

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Research Areas: Engineering
Faculty Name: Faculty of Engineering
Department Name: Aeronautical Engineering
DSR No.: 6105
DEPARTMENT OF
CHEMICAL AND MATERIALS ENGINEERING
1. A comparative study for adsorption of carbolic acid by synthetic resins

Uslu, H (Uslu, Hasan); Bamufleh, HS (Bamufleh, Hisham S.)

Abstract

Carbolic Acid which is called phenol is one of the important starting and/or intermediate materials in various industrial processes. However, its excessive release into environment poses a threat to living organisms, as it is a highly carcinogens and hazardous pollutant even at the very low concentration. Thus removal of phenol from polluted environments is very crucial for sustainable remediation process. We developed a low cost adsorption method for separating phenol from a model aqueous solution. The phenol adsorption was studied using two adsorbents i.e., Amberlite XAD-16 and Amberlite XAD-7 HP with a constant amount of resin 0.1 g at varying aqueous phenol concentrations (50-200 mg L\(^{-1}\)) at room temperature. We compared the efficacy of two phenol adsorbents for removing higher phenol concentrations from the media. We investigated equilibrium and kinetics studies of phenol adsorption employing Freundlich, Temkin and Langmuir isotherms. Amberlite XAD-16 performed better than Amberlite XAD-7 HP in terms of phenol removal efficiency that amounted to 95.52%. Pseudo second order model was highly fitted for both of the adsorption systems. The coefficient of determination (R\(^2\)) with Langmuir isotherm was found to be 0.98 for Amberlite XAD-7 HP. However, Freundlich isotherm showed R\(^2\) value of 0.95 for Amberlite XAD-16, indicating that both isotherms could be described for the isotherms on XAD-7 HP and Amberlite XAD-16, respectively.

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Research Areas: Engineering; Water Resources
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 4594
2. A comparative study for adsorption of carbolic acid by synthetic resins

Uslu, H (Uslu, Hasan); Bamufleh, HS (Bamufleh, Hisham S.)

Abstract

Carbolic Acid which is called phenol is one of the important starting and/or intermediate materials in various industrial processes. However, its excessive release into environment poses a threat to living organisms, as it is a highly carcinogens and hazardous pollutant even at the very low concentration. Thus removal of phenol from polluted environments is very crucial for sustainable remediation process. We developed a low cost adsorption method for separating phenol from a model aqueous solution. The phenol adsorption was studied using two adsorbents i.e., Amberlite XAD-16 and Amberlite XAD-7 HP with a constant amount of resin 0.1 g at varying aqueous phenol concentrations (50-200 mg L-1) at room temperature. We compared the efficacy of two phenol adsorbents for removing higher phenol concentrations from the media. We investigated equilibrium and kinetics studies of phenol adsorption employing Freundlich, Temkin and Langmuir isotherms. Amberlite XAD-16 performed better than Amberlite XAD-7 HP in terms of phenol removal efficiency that amounted to 95.52%. Pseudo second order model was highly fitted for both of the adsorption systems. The coefficient of determination (R²) with Langmuir isotherm was found to be 0.98 for Amberlite XAD-7 HP. However, Freundlich isotherm showed R² value of 0.95 for Amberlite XAD-16, indicating that both isotherms could be described for the isotherms on XAD-7 HP and Amberlite XAD-16, respectively.

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Research Areas: Engineering; Water Resources
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 4644
A theoretical investigation of CO dissociation energy barrier over gamma-Mo2N(111) plane has been performed using density functional theory. CO dissociation energy possesses a high activation barrier of 67.96 kcal.mol(-1) with an endothermic heat of reaction of 28.87 kcal.mol(-1), starting with CO molecularly adsorbed on a 3-fold hollow fcc site with an adsorption energy of 35.98 kcal.mol(-1). The activation barrier is little less, 53.03 kcal.mol(-1), when CO is molecularly adsorbed on a 3-fold hollow hcp site with an adsorption energy of 34.34 kcal.mol(-1). For both cases, the C-O bond dissociation process is kinetically unfavourable over the investigated surface. A pronounced electronic effect of ligand nitrogen (N) and underlying molybdenum (Mo) layer during bond formation at the surface was observed.
4. A dispersed rutile-TiO2-supported Ni nanoparticle for enhanced gas production from catalytic hydrothermal gasification of glucose

Li, S (Li, Sha); Zhu, C (Zhu, Chao); Guo, SM (Guo, Simao); Guo, LJ (Guo, Liejin)

Abstract

Hydrothermal gasification (HTG) is a promising technique for the utilization of wet biomass or organic wastes. This study reports a highly dispersed rutile-TiO2-supported Ni nanoparticle synthesized by a sol-gel method and its catalytic performance for gas production (H2 and CH4) from HTG of glucose as a model compound of biomass. NiTiO3 formation of the gel precursor during the calcination process demonstrated the enhanced interaction of Ni and TiO2, and highly dispersive nickel crystallites were obtained after the reduction activation. Increase of the calcination temperature decreased the catalytic activity due to the sintering of nickel crystals. The supported Ni nanoparticle greatly promoted the carbon gasification efficiency of HTG of 10 wt% glucose (glucose : Ni = 1 : 0.11) from 27.1% to 68.7% at 400 degrees C and from 48.2% to 96.4% at 600 degrees C in supercritical water. A highly active temperature region (400-500 degrees C) of nickel catalyzed methanation reaction for CH4 formation was particularly confirmed. As the gasification was prolonged in supercritical water, the rutile-TiO2-supported Ni nanoparticle showed stable crystalline structures and part of the deposited carbon was gasified. The regenerated catalysts also showed significant activities.
5. A spectral tau algorithm based on Jacobi operational matrix for numerical solution of time fractional diffusion-wave equations

Bhrawy, AH (Bhrawy, A. H.); Doha, EH (Doha, E. H.); Baleanu, D (Baleanu, D.); Ezz-Eldien, SS (Ezz-Eldien, S. S.)

Abstract

In this paper, an efficient and accurate spectral numerical method is presented for solving second-, fourth-order fractional diffusion-wave equations and fractional wave equations with damping. The proposed method is based on Jacobi tau spectral procedure together with the Jacobi operational matrix for fractional integrals, described in the Riemann-Liouville sense. The main characteristic behind this approach is to reduce such problems to those of solving systems of algebraic equations in the unknown expansion coefficients of the sought-for spectral approximations. The validity and effectiveness of the method are demonstrated by solving five numerical examples. Numerical examples are presented in the form of tables and graphs to make comparisons with the results obtained by other methods and with the exact solutions more easier. (C) 2014 Elsevier Inc. All rights reserved.

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Web of Science Categories: Computer Science, Interdisciplinary Applications; Physics, Mathematical
Research Areas: Computer Science; Physics
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 5755
Abstract

In this article, we propose the shifted Legendre orthonormal polynomials for the numerical solution of the fractional optimal control problems that appear in several branches of physics and engineering. The Rayleigh-Ritz method for the necessary conditions of optimization and the operational matrix of fractional derivatives are used together with the help of the properties of the shifted Legendre orthonormal polynomials to reduce the fractional optimal control problem to solving a system of algebraic equations that greatly simplifies the problem. For confirming the efficiency and accuracy of the proposed technique, an illustrative numerical example is introduced with its approximate solution.
7. An overview of the role of ionic liquids in biodiesel reactions

Muhammad, N (Muhammad, Nawshad); Elsheikh, YA (Elsheikh, Yasir A.); Mutalib, MIA (Mutalib, Muhammad Ibrahim Abdul); Bazmi, AA (Bazmi, Aqeel Ahmed); Khan, RA (Khan, Rahmat Ali); Khan, H (Khan, Hidayatullah); Rafiq, S (Rafiq, Sikander); Man, Z (Man, Zakaria); Khan, I (Khan, Ihsnullah)

Abstract

The concerns on the depleting petroleum resources and increasing environmental problems have driven the scientific community worldwide to develop large-scale non-petroleum-based alternative fuels, such as bioethanol and biodiesel. Biodiesel produced through the transesterification of vegetable oils or animal fats are highly attractive. On the other hand, ionic liquids which possess properties that are more environmental friendly have found significant applications as solvents and catalysts for reaction and separation. It is also beginning to find its way in many of the chemical process applications and has attracted significant attention including biodiesel production. This paper provides a brief overview on the feasibility of applying ionic liquids in biodiesel production for the purpose of powering diesel engines for transportation and utility generation. The potential of applying ionic liquids as catalyst and solvent for enzymatic production of biodiesel from feedstock is particularly highlighted. (C) 2014 The Korean Society of Industrial and Engineering Chemistry. Published by Elsevier B.V. All rights reserved.

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Publisher: ELSEVIER SCIENCE INC
Web of Science Categories: Chemistry, Multidisciplinary; Engineering, Chemical
Research Areas: Chemistry; Engineering
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 7324
8. Analysis of UV spectral bands using multidimensional scaling

Machado, JAT (Tenreiro Machado, J. A.); Dinc, E (Dinc, Erdal); Baleanu, D (Baleanu, Dumitru)

Abstract

This study describes the change of the ultraviolet spectral bands starting from 0.1 to 5.0 nm slit width in the spectral range of 200-400 nm. The analysis of the spectral bands is carried out by using the multidimensional scaling (MDS) approach to reach the latent spectral background. This approach indicates that 0.1 nm slit width gives higher-order noise together with better spectral details. Thus, 5.0 nm slit width possesses the higher peak amplitude and lower-order noise together with poor spectral details. In the above-mentioned conditions, the main problem is to find the relationship between the spectral band properties and the slit width. For this aim, the MDS tool is to used recognize the hidden information of the ultraviolet spectra of sildenafil citrate by using a Shimadzu UV-VIS 2550, which is in the world the best double monochromator instrument. In this study, the proposed mathematical approach gives the rich findings for the efficient use of the spectrophotometer in the qualitative and quantitative studies.
9. Application of continuous wavelet transform to the analysis of the modulus of the fractional Fourier transform bands for resolving two component mixture

Dinc, E (Dinc, Erdal); Duarte, FB (Duarte, Fernando B.); Machado, JAT (Machado, J. A. Tenreiro); Baleanu, D (Baleanu, Dumitru)

Abstract

In this paper, the fractional Fourier transform (FrFT) is applied to the spectral bands of two component mixture containing oxendazole and oxyclozanide to provide the multicomponent quantitative prediction of the related substances. With this aim in mind, the modulus of FrFT spectral bands are processed by the continuous Mexican Hat family of wavelets, being denoted by MEXH-CWT-MOFrFT. Four modulus sets are obtained for the parameter of the FrFT going from 0.6 up to 0.9 in order to compare their effects upon the spectral and quantitative resolutions. Four linear regression plots for each substance were obtained by measuring the MEXH-CWT-MOFrFT amplitudes in the application of the MEXH family to the modulus of the FrFT. This new combined powerful tool is validated by analyzing the artificial samples of the related drugs, and it is applied to the quality control of the commercial veterinary samples.
10. Assessment and analysis of wind power resource using weibull parameters

Bassyouni, M (Bassyouni, M.); Gutub, SA (Gutub, Saud A.); Javaid, U (Javaid, Umair); Awais, M (Awais, Muhammad); Rehman, S (Rehman, Shafiqur); Abdel-Hamid, SMS (Abdel-Hamid, S. M. -S); Abdel-Aziz, MH (Abdel-Aziz, M. H.); Abouel-Kasem, A (Abouel-Kasem, A.); Shafeek, H (Shafeek, Hani)

Abstract

In this study, wind data of eleven years (2002-2012) has been used to determine wind characteristics of Saudi Arabian city Jeddah. These characteristics include the daily, monthly and annual wind speed, wind probability density distribution, shape (k) and scale (c) parameters at 10 m height. The analysis revealed that yearly values of k ranged from 1.398 to 1.763 with a mean value of 1.590 and values of scale parameter c varied from 3.146 to 4.329 with mean value of 3.95. Furthermore, the results showed that maximum and minimum wind power potential was observed in the month of March and February, respectively. The wind was found to be blowing predominantly from south east direction. It was found that wind potential of the region can be used for small scale off-grid wind applications.

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Web of Science Categories : Energy & Fuels
Research Areas : Energy & Fuels
Faculty Name : Faculty of Engineering
Department Name : Chemical and Materials Engineering
DSR No. : 8112
11. BIOLOGICAL TREATMENT OF HYDROGEN SULFIDE IN AN AIRLIFT BIOREACTOR WITH DIRECT GAS INJECTION

Zytoon, MA (Zytoon, Mohamed A.); El-Shazly, AH (El-Shazly, Ahmed H.); Noweir, MH (Noweir, Madbuli H.); Al-Zahrani, AA (Al-Zahrani, Abdulraheem A.)

Abstract

Bioconversion of H2S into elemental sulfur has been investigated using an airlift bioreactor with direct injection of the gas into the bioreactor. Almost complete removal of H2S has been achieved at its inlet concentrations lower than 25,000 ppm. Maximum bioconversion capacity of ca 111.3 g/(m³·h) and up to 93.5% conversion of the inlet sulfide to elemental sulfur was obtained. To further improve the bioreactor performance, factors influencing mass transfer and biological activity should be investigated in future studies.

Sources

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Publisher: TECHNICAL UNIV WROCLAW
Web of Science Categories: Engineering, Environmental
Research Areas: Engineering
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 7532
12. CERTAIN NEW GRUSS TYPE INEQUALITIES INVOLVING SAIGO FRACTIONAL q-INTEGRAL OPERATOR

Wang, GT (Wang, Guotao); Agarwal, P (Agarwal, Praveen); Baleanu, D (Baleanu, Dumitru)

Abstract

In the present paper, we aim to investigate a new q-integral inequality of Gruss type for the Saigo fractional q-integral operator. Some special cases of our main results are also provided. The results presented in this paper improve and extend some recent results.
13. Colored Noise Induced Bistable Switch in the Genetic Toggle Switch Systems

Wang, P (Wang, Pei); Lu, JH (Lu, Jinhu); Yu, XH (Yu, Xinghuo)

Abstract

Noise can induce various dynamical behaviors in nonlinear systems. White noise perturbed systems have been extensively investigated during the last decades. In gene networks, experimentally observed extrinsic noise is colored. As an attempt, we investigate the genetic toggle switch systems perturbed by colored extrinsic noise and with kinetic parameters. Compared with white noise perturbed systems, we show there also exists optimal colored noise strength to induce the best stochastic switch behaviors in the single toggle switch, and the best synchronized switching in the networked systems, which demonstrate that noise-induced optimal switch behaviors are widely in existence. Moreover, under a wide range of system parameter regions, we find there exist wider ranges of white and colored noises strengths to induce good switch and synchronization behaviors, respectively; therefore, white noise is beneficial for switch and colored noise is beneficial for population synchronization. Our observations are very robust to extrinsic stimulus strength, cell density, and diffusion rate. Finally, based on the Waddington's epigenetic landscape and the Wiener-Khintchine theorem, physical mechanisms underlying the observations are interpreted. Our investigations can provide guidelines for experimental design, and have potential clinical implications in gene therapy and synthetic biology.
14. Columnar ordering properties of fluorinated and non-fluorinated tris(hexaalkoxytriphenylene)tristriazolotriazines

Umesh, CP (Umesh, C. P.); Marcelis, ATM (Marcelis, Antonius T. M.); Zuilhof, H (Zuilhof, Han)

Abstract

Two new series of columnar discotic liquid crystalline materials based on a tristriazolotriazine (TTT) core connected to three pendant hexyloxytriphenylene or pentafluoropentyloxytriphenylene groups via a flexible alkyl spacer are synthesised and investigated. It is found that the mesophase stability is very much dependent on the spacer length. For a short spacer length (propyl or butyl), Col(h) phases are found in which the disc-like moieties are randomly mixed in the columns. For one compound with a pentyl spacer and pentafluoropentyloxy tails on the triphenylene groups, a Col(ob) phase is found in which the columns of triphenylenes and TTT moieties are separated. When the spacer is longer (hexyl), the liquid crystallinity is lost. The compounds with pentafluoropentyloxy tails on the triphenylene units have a higher thermal stability than those with hexyloxy tails.
15. Competitive Adsorption of Pb-II, Ni-II, and Sr-II Ions on Graphene Oxides: A Combined Experimental and Theoretical Study

Yang, SB (Yang, Shubin); Chen, CL (Chen, Changlun); Chen, Y (Chen, Yue); Li, JX (Li, Jiaxing); Wang, DQ (Wang, Dongqi); Wang, XK (Wang, Xiangke); Hu, WP (Hu, Wenping)

Abstract

The individual and competitive adsorption of Pb-II, Ni-II, and Sr-II on graphene oxides (GOs) was investigated by experimental and density functional theory (DFT) studies. Experimental results indicate that 1) in all the single, binary, and ternary metal-ion adsorption systems, the sequence of maximum adsorption capacities is Pb-II>Ni-II>Sr-II on GOs; 2) the desorption hysteresis of metal ions from GOs shows the adsorption affinity in the same sequence: Pb-II>Ni-II>Sr-II. For the first time, DFT calculations indicate that 1) Pb-II and Ni-II prefer to interact with the COH group, whereas Sr-II interacts with COH and COC comparably, and 2) Pb-II can easily abstract the OH group from the GOs to form the much more stable Pb(OH)-GO complex. These findings are very important and useful for understanding the mechanisms of heavy-metal-ion adsorption on GOs and assessing the adsorption of coexisting heavy-metal ions on GOs.
16. Continuous-Flow Alcohol Protection and Deprotection Reactions Catalyzed by Silica-Supported Sulfonic Acid

van den Berg, SA (van den Berg, Sebastiaan A.); Frijns, RAM (Frijns, Raoul A. M.); Wennekes, T (Wennekes, Tom); Zuilhof, H (Zuilhof, Han)

Abstract

Alcohol protection and deprotection reactions, catalyzed by solid-supported sulfonic acid, have been investigated under continuous-flow conditions. Primary, secondary, benzylic and phenolic alcohols can be protected under these conditions by tetrahydropyranyl and several silyl ether moieties, generating synthetically useful amounts of material in short time. Furthermore, the described setup can be used to deprotect protected alcohols and be used in selective protection reactions. Because the solid-supported acid catalyst is continually reused in a packed-bed approach, workup is greatly simplified and in most cases only solvent removal is necessary, while reaching high turn-over numbers.
17. Controlling the Dopant Dose in Silicon by Mixed-Monolayer Doping

Ye, L (Ye, Liang); Pujari, SP (Pujari, Sidharam P.); Zuilhof, H (Zuilhof, Han); Kudernac, T (Kudernac, Tibor); de Jong, MP (de Jong, Michel P.); van der Wiel, WG (van der Wiel, Wilfred G.); Huskens, J (Huskens, Jurriaan)

Abstract

Molecular monolayer doping (MLD) presents an alternative to achieve doping of silicon in a nondestructive way and holds potential for realizing ultrashallow junctions and doping of nonplanar surfaces. Here, we report the mixing of dopant-containing alkenes with alkenes that lack this functionality at various ratios to control the dopant concentration in the resulting monolayer and concomitantly the dopant dose in the silicon substrate. The mixed monolayers were grafted onto hydrogen-terminated silicon using well-established hydrosilylation chemistry. Contact angle measurements, X-ray photon spectroscopy (XPS) on the boron-containing monolayers, and Auger electron spectroscopy on the phosphorus-containing monolayers show clear trends as a function of the dopant-containing alkene concentration. Dynamic secondary-ion mass spectroscopy (D-SIMS) and Van der Pauw resistance measurements on the in-diffused samples show an effective tuning of the doping concentration in silicon.
Abstract

Herein we present a simple method for fabricating core-shell mesostructured CuO@C nanocomposites by utilizing humic acid (HA) as a biomass carbon source. The electrochemical performances of CuO@C nanocomposites were evaluated as an electrode material for supercapacitors and lithium-ion batteries. CuO@C exhibits an excellent capacitance of 207.2 Fg(-1) at a current density of 1 Ag-1 within a potential window of 0-0.46 V in 6m KOH solution. Significantly, CuO electrode materials achieve remarkable capacitance retentions of approximately 205.8 Fg(-1) after 1000 cycles of charge/discharge testing. The CuO@C was further applied as an anode material for lithium-ion batteries, and a high initial capacity of 1143.7 mAhg(-1) was achieved at a current density of 0.1 C. This work provides a facile and general approach to synthesize carbon-based materials for application in large-scale energy-storage systems.
19. Covalent Attachment of 1-Alkenes to Oxidized Platinum Surfaces

Alonso, JM (Alonso, Jose Maria); Fabre, B (Fabre, Bruno); Trilling, AK (Trilling, Anke K.); Scheres, L (Scheres, Luc); Franssen, MCR (Franssen, Maurice C. R.); Zuilhof, H (Zuilhof, Han)

Abstract

We report the formation of covalently bound alkyl layers onto oxidized Pt (PtOx) substrates by reaction with 1-alkenes as a novel way to bind organic molecules to metal surfaces. The organic layers were characterized by static contact angle, infrared reflection absorption spectroscopy (IRRAS), X-ray photoelectron spectroscopy (XPS), and atomic force microscopy (AFM). The grafted alkyl layers display a hydrolytic stability that is comparable to that of alkyl thiols on Au. PtOx-alkene attachment is compatible with terminal ester moieties enabling further anchoring of functional groups, such as redox-active ferrocene, and thus has great potential to extend monolayer chemistry on noble metals.
20. Detection of Lead and Cadmium Ions by Voltammetry using Antimony Impregnated Activated Carbon

Farooqi, MO (Farooqi, Muhammad Omer); Taimoor, AA (Taimoor, Aqeel Ahmad); Al-Shahrani, S (Al-Shahrani, Saad); Baleanu, D (Baleanu, Dumitru); Rather, SU (Rather, Sami Ullah)

Abstract

This work deals with antimony-impregnated activated carbon electrode for the detection of heavy metal ions. Activated carbon is employed to enhance the surface area of the working electrode. Square-wave Anodic Stripping Voltammetry is performed to analyze the electrolytic solution. The peak currents for cadmium and lead are 29.2 and 49.44 µA respectively, in 100 µg/L of cadmium and lead solution, which are considerably higher when equated with the previous reported values. Results also indicate that antimony-impregnated activated carbon is better when compared with the ratio of antimony amount to minimum detection limit.
21. DEVELOPMENT OF A MULTI CONVERGENCE-CONTROLLER
PARAMETRIC PERTURBATION APPROACH FOR SOME LINEAR AND
NONLINEAR INTEGRAL EQUATIONS

Sayevand, K (Sayevand, K.); Baleanu, D (Baleanu, Dumitru); Fardi, M (Fardi, M.)

Abstract

In this article, some integral equations that have been appeared in the study of physical phenomena are investigated by using the unique properties of the extended homotopy analysis method. In other words, the traditional homotopy analysis method is extended to a multi-parametric approach. Also, convergence-controller parameters are introduced to approximate the solutions of such linear and nonlinear integral equations. In this framework, the convergence of the proposed strategies is investigated. Several numerical examples are presented to illustrate the accuracy and effectiveness of the proposed approaches. The obtained results and comparison with other methods provide confirmation for the validity of our numerical schemes.
22. Discrete chaos in fractional delayed logistic maps

Wu, GC (Wu, Guo-Cheng); Baleanu, D (Baleanu, Dumitru)

Abstract

Recently the discrete fractional calculus (DFC) started to gain much importance due to its applications to the mathematical modeling of real-world phenomena with memory effect. In this paper, the delayed logistic equation is discretized by utilizing the DFC approach and the related discrete chaos is reported. The Lyapunov exponent together with the discrete attractors and the bifurcation diagrams are given.

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Publisher: SPRINGER
Web of Science Categories: Engineering, Mechanical; Mechanics
Research Areas: Engineering; Mechanics
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 6132
23. DISSOCIATIVE ADSORPTION OF HYDROGEN ON MoP (100) PLANE. A DFT STUDY

Zaman, SF (Zaman, Sharif F.); Daous, M (Daous, Mohammad); Petrov, L (Petrov, Lachezar)

Abstract

Density functional theory was applied to investigate the H-2 adsorption and dissociation energy over MoP (100) surface. It was found that hydrogen atom preferred the "bridge adsorption site" between two molybdenum atoms having an underneath phosphorous atom, with a binding energy of -61.28 kcal/mol(-1). The hydrogen molecule adsorbed over a Mo atom in "on top" arrangement shows the lower binding energy of -15.13 kcal/mol(-1), compared to hydrogen atom adsorption. H-2 dissociation over MoP (100) plane was found to be highly activated. The dissociation activation barrier is 4.2 kcal/mol(-1), which makes MoP (100) plane a more suitable plane for the investigation of the mechanism of hydrogenation reactions.

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Web of Science Categories: Multidisciplinary Sciences
Research Areas: Science & Technology - Other Topics
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 7528

Ali, AM (Ali, Arshid M.); Daous, MA (Daous, Muhammad A.); Arafat, A (Arafat, Ahmed); AlZahrani, AA (AlZahrani, Abdulraheem A.); Alhamed, Y (Alhamed, Yahia); Tuerdimaimaiti, A (Tuerdimaimaiti, Abudula); Petrov, LA (Petrov, Lachezar A.)

Abstract

Catalytic activity of nano-Au-catalyst(s) for the complete propane oxidation was investigated. The results showed that the nature of both Au precursor and support strongly influences catalytic activity of the Au-catalyst(s) for the propane oxidation. Oxidation state, size, and dispersion of Au nanoparticles in the Au-catalysts, surface area, crystallinity, phase structure, and redox property of the support are the key aspects for the complete propane oxidation. Among the studied Au-catalysts, the Au-HAuCl4-Ce catalyst is found to be the most active catalyst.

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Web of Science Categories: Nanoscience & Nanotechnology; Materials Science, Multidisciplinary
Research Areas: Science & Technology - Other Topics; Materials Science
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 7607
25. Effect of Micro- to Nanosize Inclusions upon the Thermal Conductivity of Powdered Composites with High and Low Interface Resistance

Zain-ul-Abdein, M (Zain-ul-Abdein, Muhammad); Awan, WS (Awan, Waqas S.); Ijaz, H (Ijaz, Hassan); Taimoor, AA (Taimoor, Aqeel A.); Muhammad, A (Muhammad, Ayyaz); Rather, SU (Rather, Sami Ullah)

Abstract

Materials for thermal management application require better control over the thermophysical properties, which has largely been achieved by fabricating powdered composite. There are, however, several factors like filler volume fraction, shape morphology, inclusion size, and interfacial thermal resistance that limit the effective properties of the medium. This paper presents a methodology to estimate the effective thermal conductivity of powdered composites where the filler material is more conductive than the matrix. Only a few theoretical models, such as Hasselman and Johnson (HJ) model, include the effect of interfacial resistance in their formulation. Nevertheless, HJ model does not specify the nature of the interfacial thermal resistance. Although Sevostianov and Kachanov (SK) method takes care of interface thickness, they, on the other hand, have not taken into account the interfacial resistance due to atomic imperfections. In the present work, HJ model has been modified using SK method and the results were compared with experimental ones from the literature. It has been found that the effect of interfacial resistance is significant in highly resistive medium at microscale compared to nanoscale, such as Cu/diamond system, while, in a highly conductive medium, like bakelite/graphite system, the effect of shape factor is more significant than interfacial thermal resistance.

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Research Areas: Science & Technology - Other Topics; Materials Science
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 7645
26. EFFECT OF MODIFIED KAOLINITE BY USING FATTY ACIDS ON NR- AND SBR-REINFORCED COMPOSITES

Zoromba, MS (Zoromba, M. Sh.); Bassyouni, M (Basyouni, M.); Abdel-Hamid, SMS (Abdel-Hamid, S. M. -S.)

Abstract

Natural rubber (NR) and styrene butadiene rubber (SBR)-kaolinite clay (KC) composites (NR-KC and SBR-KC) were synthesized and characterized. The interfacial surface between rubber and KC was investigated in the presence of stearic acid (SA), palmitic acid (PA), and oleic acid (OA) coupling agents. A monolayer of modifiers was formed on the surface of KC particles. X-ray diffraction (XRD) was carried out to study the effect of fatty acid coupling agents on KC. Modifier concentrations were determined using an adsorption isotherms technique. Sedimentation rate and volumes of modified KC in toluene were measured. Rheometric characteristic and physico-mechanical properties of rubber composites were investigated. Stress-strain behavior and hardness of NR-KC and SBR-KC composites were studied. Experimental results were compared with calculated results using the Cambridge Engineering Selector program. The XRD patterns showed a decrease in the peak intensity of unmodified KC compared with modified KC, asserting an intercalation process. The optimum concentrations of chemical modifiers are 16 X 10(-5), 18 X 10(-5), and 37 X 10(-5) mol/g for SA, OA, and PA, respectively. Mechanical testing showed that high tensile strength can be obtained in the presence of the SA modifier. The degree and kinetics of equilibrium swelling and soluble fraction for NR and SBR vulcanizates were investigated.

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Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 5802
27. Efficiency of fluorinated alcohol for extraction of organic acid from its dilute aqueous solution: A model study

Luo, YH (Luo, Yuhong); Chang, ZD (Chang, Zhidong); Wu, X (Wu, Xue); Uslu, H (Uslu, Hasan); Li, WJ (Li, Wenjun); Hua, C (Hua, Chao); Liu, SX (Liu, Shixiang); Sun, CY (Sun, Changyan); Im, SJ (Im, Sunjong)

Abstract

1H,1H,2H,2H-Perfluoro-1-octanol, octanol and benzoic acid were selected as model extractant and target acid to investigate extraction behaviors of fluorinated n-alcohol. According to experimental results, the extraction capacity of 1H,1H,2H,2H-perfluoro-1-octanol is acceptable with distribution ratio (D) of 13. The extraction efficiency reaches 98.0% after three stage continuous countercurrent extraction under the conditions of pH 2.55-3.16 and temperature 20-25 degrees C at oil to water (V-o/V-w) ratio of 1. The residual of 1H,1H,2H,2H-perfluoro-1-octanol in aqueous phase was quite low, which was less than 2 ppm. The back-extraction of 1H,1H,2H,2H-perfluoro-1-octanol by NaOH was demonstrated to be feasible, which is up to 100% with single stage. (C) 2015 Elsevier B.V. All rights reserved.
28. Efficiency of fluorinated alcohol for extraction of organic acid from its dilute aqueous solution: A molecular optimization study of extractant

Luo, YH (Luo, Yuhong); Chang, ZD (Chang, Zhidong); Blamo, BJ (Blamo, Benjamin John); Wu, X (Wu, Xue); Hussain, M (Hussain, Muhammad); Uslu, H (Uslu, Hasan); Li, WJ (Li, Wenjun); Liu, SX (Liu, Shixiang); Sun, CY (Sun, Changyan); Hua, C (Hua, Chao)

Abstract

The quantum chemical parameters of fluorinated octanol, such as charge distribution, molecular electrostatic potential and frontier molecular orbital have been investigated through quantum chemistry calculation by DFT method using the B3LYP level with the standard 6-311++G(d,p) basis set. In first step the natural population analysis (NPA) and molecular electrostatic potential (MEP) methods were applied to determine the reactive site of fluorinated octanol. In second step comparative analysis of frontier molecular orbital energy gaps of fluorinated octanol and benzoic acid was used to investigate the effect of fluorinated substitutional degree on benzoic acid extraction behavior of fluorinated octanol. The calculated results suggested that the reactive site is localized on the oxygen atom and the electron donor strength of the oxygen atom decreases with the increase of the fluorinated substitional degree due to the electron-withdrawing of florous group. 1H,1H,2H,2H-perfluoro-1-octanol and 5,5,6,6,7,7,8,8-nonafluoro-1-octanol were selected as the extractants to testify the proposed theory. According to the prediction, the extraction capability on benzoic acid by 1H,1H,2H,2H-perfluoro-1-octanol is lower than that of 5,5,6,6,7,7,8,8-nonafluoro-1-octanol at room temperature. The experimental results are in agreement with the corresponding theoretical data. (C) 2015 Elsevier B.V. All rights reserved.
29. Extractability of Fumaric Acid by Tributyl Amine (TBA) in Ketones and Alcohols

Gemici, A (Gemici, Aysegul); Uslu, H (Uslu, Hasan); Kirbaslar, SI (Kirbaslar, S. Ismail)

Abstract

Fumaric acid extraction from aqueous media by tributyl amine (TBA), which is an aliphatic amine, was studied at 298 K. Ketones (methyl isobutyl ketone (MIBK), heptan-2-one, octan-2-one) and alcohols (isoamyl alcohol, octan-1-ol, decan-1-ol) were selected as the diluent for dissolving TBA. Distribution ratio (K-D), loading ratio (T), and extraction degree (D-E) were calculated from experimental results. 96% efficiency was reached with isoamyl alcohol at 2.08 mol.kg(-1) of TBA concentration. Further, the linear solvation energy relationship (LSER) modeling cooperated with Hidebrand-Hansen solubility parameters was used for prediction KD of alcoholic diluents. The LSER model gave closeness prediction to experimental data.
30. Fabrication and Properties of a Branched (NH4)(x)NO3 Nanowire Array Film and a Porous WO3 Nanorod Array Film

Liu, Y (Liu, Ya); Zhao, L (Zhao, Liang); Su, JZ (Su, Jinzhan); Li, MT (Li, Mingtao); Guo, LJ (Guo, Liejin)

Abstract

We describe the successful fabrication of a three-dimensional branched (NH4)(x)WO3 nanowire array film on fluorine-doped tin oxide coated glass by a facile one-step hydrothermal method. The porous WO3 nanorod array film formed after heat treatment and recrystallization. Specifically, the branched (NH4)(x)WO3 nanowire array film has very thin nanowires that were about 10 nm in diameter. The results of an optical and photoelectrochemical test show that the branched (NH4)(x)WO3 nanowire array film could be used as a near-infrared shielder, while the porous WO3 nanorod array film can be used as a photoanode for water splitting. Moreover, the morphology, structure, and composition of the as-prepared films are revealed, and the related changes caused by heat treatment are discussed in detail.

Sources
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Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 7076
**31. Fabrication and thermal characteristics of functionalized carbon nanotubes impregnated polydimethylsiloxane nanocomposites**

Sagar, S (Sagar, Sadia); Iqbal, N (Iqbal, Nadeem); Maqsood, A (Maqsood, Asghari); Shahid, M (Shahid, Muhammad); Shah, NA (Shah, Nazar Abbas); Jamil, T (Jamil, Tahir); Bassyouni, MI (Bassyouni, Mohamed Ismail)

**Abstract**

Multiwalled carbon nanotubes (MWCNTs) were modified to covalently attach the carboxylic moiety with their surfaces. Variant concentrations of functionalized multiwalled carbon nanotubes (F-MWCNTs) were introduced into polydimethylsiloxane (PDMS) adopting solution mixing technique. Fourier transform infrared spectroscopy (FTIR) confirms the carboxy functionalization presence on the surface of the nanotubes. X-ray diffraction (XRD) patterns for both MWCNTs and F-MWCNTs illustrate that the crystallinity does not alter with surface modification of the nanotubes. Experimental results simulated that electrical conductivity of the nanocomposites was augmented with increasing filler concentration in the host matrix. Thermal conductivity and thermal impedance of the nanocomposite specimens were evaluated according to developed methodologies and the accumulative data revealed the nanocomposites thermal transport dependence on the F-MWCNTs doping concentration in the host polymer matrix. Thermal stability enhancement with increasing filler incorporation into the polymer matrix was observed in thermogravimetric/differential thermal analyzer (TG/DTA) contours. Crystallization, glass transition, and melting temperatures were examined using differential scanning calorimeter (DSC) and it was observed that phase transition temperatures of the composite specimens can be tuned by varying the nanotubes to matrix ratio. Scanning electron microscopy and energy dispersive x-ray spectroscopy were carried out to analyze the surface morphology/composition of the fabricated nanocomposites and dispersion of functionalized and pristine MWCNTs in the polymer matrix.
32. Fabrication of reduced graphene oxide/metal (Cu, Ni, Co) nanoparticle hybrid composites via a facile thermal reduction method

Huang, XB (Huang, Xiubing); Zhao, GX (Zhao, Guixia); Wang, XK (Wang, Xiangke)

Abstract

A facile thermal reduction method has been proposed for the fabrication of reduced graphene oxide/metal (e.g., Cu, Co, Ni) nanoparticle hybrid composites at 500 degrees C for 90 minutes under flowing argon due to the release of reductive gas by thermolysis of graphene oxide. The loading amount and dispersion of metal nanoparticles could be easily controlled via the mass ratio of graphene oxide/metal nitrate precursor and the calcination temperature. The results show that with the increase of graphene oxide/metal nitrate mass ratio, it is easier to obtain pure metallic nanoparticles with high dispersion and small nanoparticle size.

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Faculty Name : Faculty of Engineering
Department Name : Chemical and Materials Engineering
DSR No. : 7951
Facile preparation of BiVO4 nanoparticle film by electrostatic spray pyrolysis for photoelectrochemical water splitting

Liu, X (Liu, Xu); Liu, Y (Liu, Ya); Su, JZ (Su, Jinzhan); Li, MT (Li, Mingtao); Guo, LJ (Guo, Liejin)

Abstract

Bismuth vanadate has a band structure that is well-suited for potential use as a photoanode in solar water splitting. Here we describe the successful fabrication of a densely uniform BiVO4 nanoparticle film on fluorine-doped tin oxide coated glass based on an electrostatic spray pyrolysis process. The deposition temperature and the mole ratio of Bi/V were controlled to find the optimal preparation condition. The optimized thin film has a monoclinic crystal structure, and the diameter of the nanoparticles is about 20-80 nm. Under simulated AM 1.5G illumination, the best performing photocurrent density can reach to 0.8 mA/cm² at an applied potential of 1.9 V versus RHE while the corresponding average incident photon to current conversion efficiency within the absorption range is similar to 5%. Besides, the synthesis details discussed in this work can provide a generic route for preparing other binary oxide films. Copyright (C) 2015, Hydrogen Energy Publications, LLC. Published by Elsevier Ltd. All rights reserved.
34. Forming forces in incremental forming of a geometry with corner feature: investigation into the effect of forming parameters using response surface approach

Al-Ghamdi, KA (Al-Ghamdi, Khalid A.); Hussain, G (Hussain, G.)

Abstract

Single-point incremental forming (SPIF) is an emerging sheet forming process. The force-parameter correlation is yet not well clear in this process, specifically for geometries with corners. In the present study, a new level of understanding on the parameter-force relationship is presented. A simple shape with corners (i.e., frustum of pyramid containing corners and oblique wall) is opted as the test geometry. Following the response surface method, a design of experiments (DoE) comprising of 47 runs obtained by varying five forming parameters namely sheet thickness, tool diameter, wall angle, step size, and flow stress is performed. The analysis of the results reveals that the parameter-force relation in SPIF is complex and interactive, explaining that the effect of variation in a parameter on the force magnitude is closely associated with the value and the type of the other parameters employed for forming. From the analysis of the forces involved in forming the pyramid, it is found that the corner requires more force than does the wall. Further, the normal force (i.e., force along normal to sheet plane) is greater than the in-plane force. The use of very small tools, especially low d/t(o) where d is the tool diameter and t(o) is the sheet thickness, is observed to cause fabrication defects leading to substantial rise in the magnitude of forming force thus endangering the machine tool. Finally, a set of force models is proposed using which one can predict a set of forming parameters simultaneously minimizing the force and preventing the fabrication problems.

Sources

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Research Areas : Automation & Control Systems; Engineering
Faculty Name : Faculty of Engineering
Department Name : Chemical and Materials Engineering
DSR No. : 7215
35. FRACTAL BOUNDARY VALUE PROBLEMS FOR INTEGRAL AND DIFFERENTIAL EQUATIONS WITH LOCAL FRACTIONAL OPERATORS

Yang, XJ (Yang, Xiao-Jun); Baleanu, D (Baleanu, Dumitru); Lazarevic, MP (Lazarevic, Mihailo P.); Cajic, MS (Cajic, Milan S.)

Abstract

In the present paper we investigate the fractal boundary value problems for the Fredholm and Volterra integral equations, heat conduction and wave equations by using the local fractional decomposition method. The operator is described by the local fractional operators. The four illustrative examples are given to elaborate the accuracy and reliability of the obtained results.
36. GENERALIZED LAGUERRE-GAUSS-RADAU SCHEME FOR FIRST ORDER HYPERBOLIC EQUATIONS ON SEMI-INFINITE DOMAINS

Bhrawy, AH (Bhrawy, A. H.); Hafez, RM (Hafez, R. M.); Alzahrani, EO (Alzahrani, E. O.); Baleanu, D (Baleanu, D.); Alzahrani, AA (Alzahrani, A. A.)

Abstract

In this article, we develop a numerical approximation for first-order hyperbolic equations on semi-infinite domains by using a spectral collocation scheme. First, we propose the generalized Laguerre-Gauss-Radau collocation scheme for both spatial and temporal discretizations. This in turn reduces the problem to the obtaining of a system of algebraic equations. Second, we use a Newton iteration technique to solve it. Finally, the obtained results are compared with the exact solutions, highlighting the performance of the proposed numerical method.
37. Hydrogen production by ammonia decomposition using Co catalyst supported on Mg mixed oxide systems

Podila, S (Podila, Seetharamulu); Alhamed, YA (Alhamed, Yahia A.); AlZahrani, AA (AlZahrani, Abdulrahim A.); Petrov, LA (Petrov, Lachezar A.)

Abstract

Ammonia decomposition for hydrogen production was studied using cobalt catalysts supported on different Mg mixed oxide systems (MgAl, MgCe and MgLa) to elucidate the influence of support composition on the activity of these catalysts. For this purpose three supports of Mg to X ratio (X = Al, Ce or La) equal to two were prepared. These supports were applied to synthesis 5 wt% cobalt samples by impregnation. The catalytic performance was evaluated in the temperature range of 300-550 degrees C at atmospheric pressure. It was found that 5CMLa-2 (5 wt% Co impregnated on MgLa support with Mg:La = 2:1) has the highest activity among the other catalysts and the decreasing order of NH3 conversion as follows: 5CMLa-2 > 5CMCe-2 5CMA1-2. Another series of mixed Mg-La oxide supports with different Mg/La molar ratios (Mg/La = 1, 2,3,5,9 and 14) were prepared and impregnated with 5 wt% cobalt. The prepared catalysts were characterized by BET, XRD, TPR, XPS and CO chemisorptions techniques. Investigation of the effect of La content in the mixed oxide support showed that the 5 wt% cobalt with Mg/La ratio 5 catalyst was the most active. This could be attributed to enhance the interaction between Mg and La which leads to suitable basicity for ammonia decomposition reaction. The increase of MgO content creates high surface area, high active metal area and high surface lattice oxygen (i.e. O2-). From TPD data the basic sites become stronger in the Mg-La mixed oxide at Mg/La = 5 ratio. 5CMLa-5 (5 wt% Co on MgLa with ratio 5:1) is showing highest activity among all catalysts with other Mg/La ratios. The enrichment in activity of 5CMLa-5 catalyst could be attributed to increase in surface area, metal dispersion, easily reducible Co species and high basicity. Copyright (C) 2015, Hydrogen Energy Publications, LLC. Published by Elsevier Ltd. All rights reserved.

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Department Name: Chemical and Materials Engineering
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38. **Industrial waste heat recovery and cogeneration involving organic Rankine cycles**

Gutierrez-Arriaga, CG (Giovani Gutierrez-Arriaga, Cesar); Abdelhady, F (Abdelhady, Faissal); Bamufleh, HS (Bamufleh, Hisham S.); Serna-Gonzalez, M (Serna-Gonzalez, Medardo); El-Halwagi, MM (El-Halwagi, Mahmoud M.); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose)

**Abstract**

This paper proposes a systematic approach for energy integration involving waste heat recovery through an organic Rankine cycle (ORC). The proposed approach is based on a two-stage procedure. In the first stage, heating and cooling targets are determined through heat integration. This enables the identification of the excess process heat available for use in the ORC. The optimization of the operating conditions and design of the cogeneration system are carried out in the second stage using genetic algorithms. A modular sequential simulation approach is proposed including several correlations to determine the properties for the streams in the ORC. The proposed approach is applied to a case study which addresses the tradeoffs among the different forms of energy and associated costs. The results show that the optimal selection of the operating conditions and working fluid is very important to reduce the costs associated to the process.
39. Investigation of the fractional diffusion equation based on generalized integral quadrature technique

Razminia, K (Razminia, Kambiz); Razminia, A (Razminia, Abolhassan); Baleanu, D (Baleanu, Dumitru)

Abstract

Nowadays, the conventional Euclidean models are mostly used to describe the behavior of fluid flow through porous media. These models assume the homogeneity of the reservoir, and in naturally fractured reservoir, the fractures are distributed uniformly and use the interconnected fractures assumption. However, several cases such as core, log, outcrop data, production behavior of reservoirs, and the dynamic behavior of reservoirs indicate that the reservoirs have a different behavior other than these assumptions in most cases. According to the fractal theory and the concept of fractional derivative, a generalized diffusion equation is presented to analyze the transport in fractal reservoirs. Three outer boundary conditions are investigated. Using exact analytical or semi-analytical solutions for generalized diffusion equation with fractional order differential equation and a fractal physical form, under the usual assumptions, requires large amounts of computation time and may produce inaccurate and fake results for some combinations of parameters. Because of fractionality, fractal shape, and therefore the existence of infinite series, large computation times occur, which is sometimes slowly convergent. This paper provides a computationally efficient and accurate method via differential quadrature (DQ) and generalized integral quadrature (GIQ) analyses of diffusion equation to overcome these difficulties. The presented method would overcome the imperfections in boundary conditions’ implementations of second-order partial differential equation (PDE) encountered in such problems. (C) 2014 Elsevier Inc. All rights reserved.

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Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 8269
Investigations on the Reactive Extraction of Glyoxylic Acid by Amberlite-LA2 Dissolved in Alcoholic Diluents

Uslu, H (Uslu, Hasan); Datta, D (Datta, Dipaloy); Kumar, S (Kumar, Sushil)

Abstract

In this study, reactive extraction of glyoxylic acid (0.93 kmol.m(-3)) using Amberlite-LA2 (0.24 to 1.67 kmol.m(-3)) in five different alcoholic diluents is performed at 298 K. The extraction ability of Amberlite-LA2 is found to be in the order of isoamyl alcohol (IAA) > nonan-1-ol > octan-1-ol > decan-1-ol > dodecanol. Maximum extraction efficiency, 98.92% is obtained at 1.67 kmol.m(-3) of Amberlite-LA2 in IAA. The values of stoichiometric coefficient (m), overall equilibrium constant (K-E) and individual constants (K-11, K-21, and K-12) are estimated. The effect of diluent on K-D is also quantified by applying LSER model using solvatochromic parameters of diluents.
Investigations on the Structural and Mechanical Properties of Polyurethane Resins Based on Cu(II)phthalocyanines

Youssef, TE (Youssef, Tamer E.); Al-Turaif, H (Al-Turaif, Hamad); Wazzan, AA (Wazzan, AbdulAziz A.)

Abstract

This work report was reported on the effect of the addition of organic filler, that is, 2(3), 9(10), 16(17), 23(24)-octahydroxycopper(II)phthalocyanine [[OH](8)CuPc] (3), on the thermal, tensile, and morphological properties of a polyurethane matrix. The mechanical and dynamic mechanical thermal tests together with microstructural characterization of CuPc/PU composites were performed. The three PU composite films containing up to 1, 15, and 30 wt% of CuPc have different behaviors in terms of their morphological issues, thermal properties, and tensile behavior in comparison with the PU film as the reference material. Very high elongations at break from 910% to 1230%, as well as high tensile strengths, illustrate excellent ultimate tensile properties of the prepared samples. The best mechanical and thermomechanical properties were found for the sample filled with 30 wt% of CuPc.
42. Involving integrated seawater desalination-power plants in the optimal design of water distribution networks

Gonzalez-Bravo, R (Gonzalez-Bravo, Ramon); Napoles-Rivera, F (Napoles-Rivera, Fabricio); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

Abstract

Water and energy consumption has increased substantially over the last decades. Water scarcity has led to an increase in the extraction of fresh water from aquifers, dams and lakes, and it has produced serious overexploitation problems. Furthermore, the population growth in urbanized areas and the increase in water and energy demands in industry, agriculture and households have amplified this problem. As consequence, there are several regions where is almost impossible to satisfy the water demands using the available water resources. In this context, the use of alternative water resources such as reclaimed water, rainwater harvesting and the potential use of desalinated water can be an option. However, desalinated seawater is very expensive because the high energy consumption, and this way to integrate a seawater desalination plant to a power plant to simultaneously produce clean water and power can be an attractive option. This way, this paper proposes an optimization formulation for synthesizing water networks to satisfy water and energy demands in a macroscopic system involving the use of existing water resources and the installation of integrated seawater desalination-power plants. A case study from Mexico (where satisfying the water demands has become a serious problem) is presented. Results show that the integrated system is able to satisfy the current water demands, the excess desalinated water can be used to recharge the overexploited aquifers and interesting profits can be obtained from the sales of power. (C) 2015 Elsevier B.V. All rights reserved.
43. Involving integrated seawater desalination-power plants in the optimal design of water distribution networks

Gonzalez-Bravo, R (Gonzalez-Bravo, Ramon); Napoles-Rivera, F (Napoles-Rivera, Fabricio); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

Abstract

Water and energy consumption has increased substantially over the last decades. Water scarcity has led to an increase in the extraction of fresh water from aquifers, dams and lakes, and it has produced serious overexploitation problems. Furthermore, the population growth in urbanized areas and the increase in water and energy demands in industry, agriculture and households have amplified this problem. As consequence, there are several regions where is almost impossible to satisfy the water demands using the available water resources. In this context, the use of alternative water resources such as reclaimed water, rainwater harvesting and the potential use of desalinated water can be an option. However, desalinated seawater is very expensive because the high energy consumption, and this way to integrate a seawater desalination plant to a power plant to simultaneously produce clean water and power can be an attractive option. This way, this paper proposes an optimization formulation for synthesizing water networks to satisfy water and energy demands in a macroscopic system involving the use of existing water resources and the installation of integrated seawater desalination-power plants. A case study from Mexico (where satisfying the water demands has become a serious problem) is presented. Results show that the integrated system is able to satisfy the current water demands, the excess desalinated water can be used to recharge the overexploited aquifers and interesting profits can be obtained from the sales of power. (C) 2015 Elsevier B.V. All rights reserved.
Jacobian matrix algorithm for Lyapunov exponents of the discrete fractional maps

Wu, GC (Wu, Guo-Cheng); Baleanu, D (Baleanu, Dumitru)

Abstract

The Jacobian matrix algorithm is often used to calculate the Lyapunov exponents of the chaotic systems. This study extends the algorithm to discrete fractional cases. The tangent maps with memory effect are presented. The Lyapunov exponents of one and two dimensional fractional logistic maps are calculated. The positive ones are used to distinguish the chaotic areas of the maps. (C) 2014 Elsevier B.V. All rights reserved.
Key steps towards the oriented immobilization of antibodies using boronic acids

Duval, F (Duval, Florine); van Beek, TA (van Beek, Teris A.); Zuilhof, H (Zuilhof, Han)

Abstract

Oriented immobilization of antibodies using boronic acids shows a strong potential for improving immunoassay performance but is not yet widely used, possibly because of the difficulties encountered in its implementation. How to choose the boronic acid structure and how should it be attached to the surface? How to choose an antibody that will bind to the boronic acid? Under which conditions should the binding take place for an effective oriented antibody immobilization? How to make sure that the antibody stays on the surface? This tutorial review provides answers to these questions through analysis of the literature and personal suggestions, and thereby intends to facilitate the development of this promising antibody immobilization strategy.

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Research Areas: Chemistry
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 7746
46. Kilogram-Scale Synthesis of Pd-Loaded Quintuple-Shelled Co3O4 Microreactors and Their Application to Ultrasensitive and Ultraselective Detection of Methylbenzenes

Yoon, JW (Yoon, Ji-Wook); Hong, YJ (Hong, Young Jun); Park, GD (Park, Gi Dae); Hwang, SJ (Hwang, Su-Jin); Abdel-Hady, F (Abdel-Hady, Faissal); Wazzan, AA (Wazzan, AbdulAziz A.); Kang, YC (Kang, Yun Chan); Lee, JH (Lee, Jong-Heun)

Abstract

We report the kilogram-scale, simple, and cost-effective synthesis of Pd-loaded quintuple-shelled Co3O4 microreactors by spray drying of aqueous droplets containing cobalt nitrate, palladium nitrate, citric acid, and ethylene glycol and subsequent heat treatment. Highly viscous gel spheres containing Co and Pd salts were successfully converted into multi thin-shelled Co3O4 reactors uniformly loaded with Pd catalysts by the sequential combustion of carbon and decomposition of the metal salts from the outer to the inner regions during one-step heat treatment. The responses (resistance ratio) of the Pd-loaded quintuple-shelled Co3O4 microreactors to 5 ppm toluene and p-xylene were 30.8 and 64.2, respectively, and the selectivity values to toluene and p-xylene against ethanol interference (response ratio) were 14.5 and 30.1, respectively. The unprecedented high response and selectivity were attributed to the effective dissociation of less reactive methylbenzenes into more active smaller species assisted both by catalytic Co3O4 and Pd during the prolonged retention within the microreactors. Kilogram-scale preparation of noble metal-loaded multishelled microreactors and their unique gas-sensing characteristics based on a novel microreactor concept can pave a new way to design of high-performance gas sensors for practical applications.
47. Kinetics of Desorption of 1,3-Diisopropylbenzene and 1,3,5-Triisopropylbenzene. 2. Diffusion in FCC Catalyst Particles by Zero Length Column Method

Zaman, SF (Zaman, Sharif F.); Loughlin, KF (Loughlin, Kevin F.); Al-Khattaf, SA (Al-Khattaf, Sulaiman A.)

Abstract

The kinetics of desorption of 1,3-diisopropylbenzene and 1,3,5-triisopropylbenzene in FCC catalyst pellets is reported employing the ZLC method as the measurement device: 20 by weight NaY zeolite (0.9 μm diameter) and 80% by weight silica alumina matrix are combined to form the FCC catalyst particles (45-55 μm diameter). The large hydrocarbon molecules 1,3-diisopropylbenzene and 1,3,5-triisopropylbenzene are adsorbed in both the zeolite and alumina matrix, influencing the equilibrium adsorption, and the desorption curves. Accordingly, the desorption plots of 10(c/c(0)) versus time for the NaY zeolite alone and for the FCC catalyst particles differ significantly in equilibria but not in the long time diffusion solutions. The intercept of the long time asymptotic diffusion plots is larger for the NaY zeolite than for the FCC catalyst particles, Signifying that more sorbate is desorbed in the ease of the FCC particles. For kinetics, the long time asymptotic diffusion plots are parallel indicating that the resistance for both the zeolite and FCC particles is similar. The time constants for diffusion for both systems are similar at the same temperatures, indicating that both systems are micropore (i.e., zeolitic) controlled.
Mass and heat transfer at an array of horizontal cylinders placed at the bottom of a square agitated vessel

Atef, NM (Atef, N. M.); Abdel-Aziz, MH (Abdel-Aziz, M. H.); Fouad, YO (Fouad, Y. O.); Farag, HA (Farag, H. A.); Sedahmed, GH (Sedahmed, G. H.)

Abstract

Rates of liquid-solid mass transfer at horizontal array of cylinders resting on the base of a square agitated vessel were studied. An electrochemical technique which involves measuring the limiting current of the cathodic reduction of K3Fe(CN)(6) in a large excess of NaOH supporting electrolyte was used. The mass transfer data were correlated by dimensionless mass transfer equations. Drag reducing polymers were found to reduce the rate of mass transfer at the tube array by an amount ranging from 2.4 to 21.8% depending on the operating conditions. The volumetric mass transfer coefficient (kA) at the tube array was found to be higher than that of the flat tank bottom cathode by a factor ranging from 4.24 to 9.33. The importance of the present study in the design and operation of stirred square tank reactor with a cooling system at the bottom was noted. Also the importance of the present results in designing semi-continuous tubular dialyzers was highlighted. The possibility of using the outer tube surface as a catalyst support and the inner surface as a cooler for conducting diffusion controlled reactions which need critical temperature control such as immobilized enzyme catalyzed biochemical reactions was discussed. (C) 2014 The Institution of Chemical Engineers. Published by Elsevier B.V. All rights reserved.
49. Metal-Free Click Chemistry Reactions on Surfaces

Escorihuela, J (Escorihuela, Jorge); Marcelis, ATM (Marcelis, Antonius T. M.);
Zuilhof, H (Zuilhof, Han)

Abstract

In the last decade, interest in the functionalization of surfaces and materials has increased dramatically. In this regard, click chemistry deserves a central focus because of its mild reaction conditions, high efficiency, and easy post-treatment. Among such novel click reactions, those that do not require any metal catalyst are of special interest, as metals may have undesirable effects in many fields. In this Review, the backgrounds and application of such metal-free click reactions for the modification of surfaces are highlighted.
50. Mild temperature palladium-catalyzed ammoxidation of ethanol to acetonitrile

Hamill, C (Hamill, Conor); Driss, H (Driss, Hafedh); Goguet, A (Goguet, Alex); Burch, R (Burch, Robbie); Petrov, L (Petrov, Lachezar); Daous, M (Daous, Muhammad); Rooney, D (Rooney, David)

Abstract

The ammoxidation of ethanol is investigated as a renewable process for the production of acetonitrile from a bio-feedstock. Palladium catalysts are shown to be active and very selective (>99%) to this reaction at moderate to low temperatures (150-240 degrees C), with acetonitrile yields considered a function of Pd morphology. Further investigations reveal that the stability of these catalysts is influenced by an unselective product, and that any deactivation observed is reversible. Interpretation of this deactivation allows operating conditions to be defined for the stable, high yielding production of acetonitrile from ethanol. (C) 2015 Published by Elsevier B.V.
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51. NEW NUMERICAL APPROXIMATIONS FOR SPACE-TIME FRACTIONAL BURGERS' EQUATIONS VIA A LEGENDRE SPECTRAL-COLLOCATION METHOD

Bhrawy, AH (Bhrawy, A. H.); Zaky, MA (Zaky, M. A.); Baleanu, D (Baleanu, D.)

Abstract

Burgers' equation is a fundamental partial differential equation in fluid mechanics. This paper reports a new space-time spectral algorithm for obtaining an approximate solution for the space-time fractional Burgers' equation (FBE) based on spectral shifted Legendre collocation (SLC) method in combination with the shifted Legendre operational matrix of fractional derivatives. The fractional derivatives are described in the Caputo sense. We propose a spectral shifted Legendre collocation method in both temporal and spatial discretizations for the space-time FBE. The main characteristic behind this approach is that it reduces such problem to that of solving a system of nonlinear algebraic equations that can then be solved using Newton's iterative method. Numerical results with comparisons are given to confirm the reliability of the proposed method for FBE.

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Bhrawy, AH (Bhrawy, Ali H.); Taha, TM (Taha, Taha M.); Alzahrani, EO (Alzahrani, Ebrahim O.); Baleanu, D (Baleanu, Dumitru); Alzahrani, AA (Alzahrani, Abdulrahim A.)
53. Noble metal@metal oxide semiconductor core@shell nano-architectures as a new platform for gas sensor applications
Rai, P (Rai, Prabhakar); Majhi, SM (Majhi, Sanjit Manohar); Yu, YT (Yu, Yeon-Tae); Lee, JH (Lee, Jong-Heun)

Abstract

Among the complex nanostructures, core@shell nanomaterials are gaining much attention, as the physical properties of the core and shell can be easily and separately tuned. Two materials in the form of core@shell nanostructures combine their individual properties and also bring unique properties in comparison with single-component materials. Recently, the formation of core@shell nanoparticles (NPs) having noble metals (Au, Ag, Pt and Pd) as a core and metal oxides semiconductors (TiO2, SnO2, and Cu2O) as a shell has attracted immense research interest in sensing, photo-catalysis, dye-sensitized solar cells and so on due to tailorability and functionality in the core and shell. Therefore, an overview of the advances in this exciting field of noble metals@metal oxides core@shell NPs has been presented in this feature article. It includes systematic synthesis approaches of noble metal@metal oxide core@shell NPs and their applications in the field of gas sensors, which is based on the literature and our own recent work. The synthesis of core@shell NPs with controllable sizes, compositions, morphologies, structures and functionalities has been presented considering the advantages and the demerits of the process. Applications of these core@shell NPs in the areas of gas sensing and their sensing mechanisms are discussed. The future prospects of such core@shell nanostructures for gas sensing applications are also highlighted.

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Publisher : ROYAL SOC CHEMISTRY
Web of Science Categories : Chemistry, Multidisciplinary
Research Areas : Chemistry
Faculty Name : Faculty of Engineering
Department Name : Chemical and Materials Engineering
DSR No. : 7760
Abstract

Using Saigo's fractional integral operators, we establish a generalized version of the Gruss type integral inequality related to the bounded integrable functions, whose bounds are integrable functions. Some special cases of our results are also considered.
55. ON MODELING THE GROUNDWATER FLOW WITHIN A CONFINED AQUIFER

Atangana, A (Atangana, Abdon); Baleanu, D (Baleanu, Dumitru)

Abstract

The groundwater flow equation is used to simulate the movement of water under the confined aquifer. In this paper we study a modification of the groundwater flow equation within a newly proposed derivative. We numerically solve the generalized groundwater flow equation with the Crank-Nicholson scheme. We also analytically solve the generalized equation via the method of separation of variable.
56. On some self-adjoint fractional finite difference equations

Baleanu, D (Baleanu, Dumitru); Rezapour, S (Rezapour, Shahram); Salehi, S (Salehi, Saeid)

Abstract

Recently, the existence of solution for the fractional self-adjoint equation $\Delta^{\nu}(\nu-1) (p \Delta y)(t) = h(t)$ for order $0 < \nu <= 1$ was reported in [9]. In this paper, we investigated the self-adjoint fractional finite difference equation $\Delta^{\nu}(\nu-2)(p \Delta u)(t) = j(t,p(t^{\nu-2}))$ via the boundary conditions $y(\nu-2) = 0$, such that $\Delta y(\nu-2) = 0$ and $\Delta y(\nu+b) = 0$. Also, we analyzed the self-adjoint fractional finite difference equation $\Delta^{\nu}(\nu-2)\Delta y(t) = j(t,(t^{\nu-2})\Delta y(t^{\nu-3}))$ via the boundary conditions $y(\nu-2) = 0$, $\Delta y(\nu-2) = 0$, $\Delta y(\nu-2) = 0$ and $\Delta y(\nu+b) = 0$. Finally, we conclude a result about the existence of solution for the general equation $\Delta^{\nu}(\nu-2)\Delta y(t) = h(t,p(t^{\nu-m-1})\Delta y(t^{\nu-m-1}))$ via the boundary conditions $y(\nu-2) = \Delta y(\nu-2) = \Delta y(\nu-2) = \Delta y(\nu+b) = 0$ for order $1 < \nu <= 2$. 

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Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
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ON THE EXACT SOLUTIONS OF NONLINEAR LONG-SHORT WAVE RESONANCE EQUATIONS

Jafari, H (Jafari, H.); Soltani, R (Soltani, R.); Khalique, CM (Khalique, C. M.); Baleanu, D (Baleanu, D.)

Abstract

The long-short wave resonance model arises when the phase velocity of a long wave matches the group velocity of a short wave. In this paper, the first integral method is used to construct exact solutions of the nonlinear long-short wave resonance equations. One-soliton solutions are also obtained using the travelling wave hypothesis.
Optimal design and integration of solar thermal collection, storage, and dispatch with process cogeneration systems

Abdelhady, F (Abdelhady, Faissal); Bamufleh, H (Bamufleh, Hisham); El-Halwagi, MM (El-Halwagi, Mahmoud M.); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose)

Abstract

This paper introduces an optimization approach to the design of process combined heat and power systems that integrate the thermal profile of the process, an external fossil fuel, and solar energy. A hierarchical design approach is proposed to stage the implementation of steady-state and dynamic calculations. Initially, energy integration is used to identify minimum heating and cooling utility targets. Next, a genetic algorithm approach is employed to optimize the external heating load and generated power of the cogeneration system that includes a steam Rankine cycle. An outer loop is used to optimize the flowrate, temperature, and pressure of the steam entering and exiting the turbine. A multiperiod optimization approach is developed to account for the diurnal variability of solar energy. Direct usage of collected solar energy is considered along with the option of thermal storage and dispatch. The solution of this mixed integer nonlinear program determines the optimal mix of energy throughout the year. A case study for a petrochemical plant in Jeddah, Saudi Arabia was solved to illustrate the applicability of the devised approach. (C) 2015 Elsevier Ltd. All rights reserved.
59. Optimal design and integration of solar thermal collection, storage, and dispatch with process cogeneration systems

Abdelhady, F (Abdelhady, Faissal); Bamufleh, H (Bamufleh, Hisham); El-Halwagi, MM (El-Halwagi, Mahmoud M.); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose)

Abstract

This paper introduces an optimization approach to the design of process combined heat and power systems that integrate the thermal profile of the process, an external fossil fuel, and solar energy. A hierarchical design approach is proposed to stage the implementation of steady-state and dynamic calculations. Initially, energy integration is used to identify minimum heating and cooling utility targets. Next, a genetic algorithm approach is employed to optimize the external heating load and generated power of the cogeneration system that includes a steam Rankine cycle. An outer loop is used to optimize the flowrate, temperature, and pressure of the steam entering and exiting the turbine. A multiperiod optimization approach is developed to account for the diurnal variability of solar energy. Direct usage of collected solar energy is considered along with the option of thermal storage and dispatch. The solution of this mixed integer nonlinear program determines the optimal mix of energy throughout the year. A case study for a petrochemical plant in Jeddah, Saudi Arabia was solved to illustrate the applicability of the devised approach. (C) 2015 Elsevier Ltd. All rights reserved.
60. **Optimal design of agricultural water systems with multiperiod collection, storage, and distribution**

Arredondo-Ramirez, K (Arredondo-Ramirez, Karla); Rubio-Castro, E (Rubio-Castro, Eusiel); Napoles-Rivera, F (Napoles-Rivera, Fabricio); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); Serna-Gonzalez, M (Serna-Gonzalez, Medardo); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

**Abstract**

Water is one of the most valuable resources in the world and the agriculture is one the largest fresh water consumers due to the low efficiencies in the irrigation processes. This paper proposes a mathematical programming model for the optimal planning of an integrated system which involves water collection, reuse, and distribution strategies. Because of the variability in water supplies and demands throughout the year, a multiperiod optimization approach is adopted. The multi-objective function includes the minimization of fresh water consumption and the minimization of the total annual cost, this cost is divided in capital cost which consists of the catchment areas, storages and pumps, as well as the operating cost for pumping and fresh water. A multi-objective mixed-integer nonlinear programming model is formulated and solved using the epsilon-constrained method. The applicability of the proposed approach was shown through a case study from the State of Michoacan in Mexico where a lot of fresh water is consumed for agricultural purposes. The results show that fresh water consumption can be significantly reduced by the implementation of the proposed approach while simultaneously addressing the economic objective. (C) 2015 Elsevier B.V. All rights reserved.
61. Optimal design of domestic water-heating solar systems
Sanchez-Bautista, AD (de Fatima Sanchez-Bautista, Aurora); Santibanez-Aguilar, JE (Ezequiel Santibanez-Aguilar, Jose); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); Napoles-Rivera, F (Napoles-Rivera, Fabricio); Serna-Gonzalez, M (Serna-Gonzalez, Medardo); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

Abstract

This paper presents a multi-criteria optimization formulation for the optimal design of a water-heating system for homes. The proposed model accounts for the available solar radiation in the specific place where the solar collector is installed and the hot water demands. The goal is to target economic and environmental objectives by optimizing the design and operating conditions including the optimal hot water storage and distribution. The proposed model is applied to several scenarios for homes with different inhabitants and in various cities in Mexico. The results show that the location has significant effects on the optimal design and operation of the water-heating solar system.
Abstract

The efficient use of water worldwide is of overriding importance due to its vital role in life. Recently, several countries have suffered water scarcity mainly due to population increase and problems associated to climate change such as the change in the precipitation patterns in the world. In this project, a mathematical programming model for the efficient and sustainable use of water under parametric uncertainty is proposed. The model considers rainwater harvesting (which includes catchment, storage and distribution) as alternative water source; it also considers sustainability aspects from the economic and environmental points of view, maximizing the revenue from the sales of water minus the cost of production and treatment, while maintaining desirable levels of water in the natural reservoirs. The uncertainty is a result of the change in the precipitation patterns. The proposed model is applied to a case study for the city of Morelia, Michoacan in Mexico, considering a time horizon of 5 years. Results show the optimal schedule for water storage and distribution to different sectors of the society (public, agricultural and industrial users). It was found that the use of alternative water sources such as harvested rainwater, along with an appropriate planning schedule of storage and distribution might help reduce the pressure over natural reservoirs even under conditions of uncertainty in the precipitation, while satisfying the water demands in a city. (C) 2014 Elsevier Ltd. All rights reserved.
63. Optimal design of reusing water systems in a housing complex

Garcia-Montoya, M (Garcia-Montoya, Mariana); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); Napoles-Rivera, F (Napoles-Rivera, Fabricio); Serna-Gonzalez, M (Serna-Gonzalez, Medardo); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

Abstract

The excessive demand for water worldwide has promoted the development of strategies for its efficient use. The industrial sector has developed several water recycle and conservation strategies that have led to reduction in the fresh water consumption and the wastewater discharged to the environment. Comparable environmental and economic benefits can accrue as a result of adopting similar water strategies in the residential sector. This paper proposes an optimization formulation for the design and operation of networks for the recycle, regeneration, and storage of water in residential complexes. Segregation of wastewater streams is considered to avoid the mixing of streams with different qualities prior to treatment and recycle. The optimization model accounts for the simultaneous minimization of the total annual cost and the fresh water consumption. A case study for a residential complex of the city of Morelia Michoacan in Mexico is used to apply the proposed approach. The results show significant economic and environmental benefits (such as reduction of natural resources consumption and waste generation) for the implementation of the proposed approach. The developed optimization model also enables tradeoff between the considered objectives.
Optimal Design of Thermal Membrane Distillation Networks

Gonzalez-Bravo, R (Gonzalez-Bravo, Ramon); Napoles-Rivera, F (Napoles-Rivera, Fabricio); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); Serna-Gonzalez, M (Serna-Gonzalez, Medardo); El-Halwagi, MM (El-Halwagi, Mahamoud M.)

Abstract

Thermal membrane distillation (TMD) is a promising separation technology which involves simultaneous heat and mass transfer through a hydrophobic semi-permeable membrane. Studies of this technology have focused on the performance of individual modules. However, due to specific purity and recovery requirements in some processes, multiple TMD modules have to be used in different configurations such as series, parallel, and combinations, which might require to reroute streams from one module to another or to recycle a stream to the same unit. This paper presents a systematic approach to synthesize an optimal TMD network. All the potential configurations are embedded within a structural representation of the problem which is then formulated as an MINLP optimization model, in which the objective function is the minimization of the total cost of the system. The advantages of the presented approach over conventional design procedures is shown through a case study dealing with the desalination of water (i.e., integrated TMD modules yield better results with respect to usual configurations).

Sources

12TH INTERNATIONAL SYMPOSIUM ON PROCESS SYSTEMS ENGINEERING (PSE) AND 25TH EUROPEAN SYMPOSIUM ON COMPUTER AIDED PROCESS ENGINEERING (ESCAPE), PT A Book Series: Computer Aided Chemical Engineering

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Department Name: Chemical and Materials Engineering
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Optimal design of thermal membrane distillation systems with heat integration with process plants

Gonzalez-Bravo, R (Gonzalez-Bravo, Ramon); Elsayed, NA (Elsayed, Nesreen A.); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); Napoles-Rivera, F (Napoles-Rivera, Fabricio); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

Abstract

This paper presents an optimization approach for the design of thermal membrane distillation (TMD) systems that are thermally coupled with processing facilities. A superstructure representation and an optimization formulation are introduced to obtain simultaneously the optimization of the TMD unit and the heat-exchange network (HEN) that integrates heating and cooling in the process facility. The superstructure and associated optimization formulation seek to identify the system configuration along with design and operating variables such as heat-exchanger areas, membrane area, extent of thermal coupling between the process and TMD, and the TMD feed-preheating temperature. The objective function maximizes the net annual profit which accounts for the revenues from the sales of purified water, the avoided cost of the treated wastewater, and the total annualized costs accounting for the capital investment of the added heat transfer units and the TMD network, the operating costs for the heating and cooling utilities and the operating expenses for the TMD system. The proposed optimization formulation is applied to a case study where a TMD system is integrated with a methanol plant and the results show significant economic benefits for the implementation of the proposed methodology. (C) 2014 Elsevier Ltd. All rights reserved.
66. Optimal planning for the reuse of municipal solid waste considering economic, environmental, and safety objectives

Santibanez-Aguilar, JE (Ezequiel Santibanez-Aguilar, Jose); Martinez-Gomez, J (Martinez-Gomez, Juan); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); Napoles-Rivera, F (Napoles-Rivera, Fabricio); Serna-Gonzalez, M (Serna-Gonzalez, Medardo); Gonzalez-Campos, JB (Betzabe Gonzalez-Campos, Janett); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

Abstract

A mathematical programming model is presented for the optimal planning of the reuse of municipal solid waste (MSW) to maximize the economic benefit while simultaneously considering sustainability and safety criteria. The proposed methodology considers several phases of the supply chain including waste separation, distribution to processing facilities, processing to obtain useful products, and distribution of products to consumers. Additionally, the safety criteria are based on the potential fatalities associated with waste management. The proposed optimization model is formulated as a multiobjective optimization problem, which considers three different objectives including the maximization of the net annual profit, the maximization of the amount of reused MSW, and the minimization of the social risk associated with the supply chain. The proposed model is applied to a case study in the central-west region of Mexico. The results show the tradeoff between the social risk and the economic and environmental criteria. (c) 2015 American Institute of Chemical Engineers AIChE J, 61: 1881-1899, 2015
Optimization of facility location and reallocation in an industrial plant through a multiannual framework accounting for economic and safety issues

Martinez-Gomez, J (Martinez-Gomez, Juan); Napoles-Rivera, F (Napoles-Rivera, Fabricio); Ponce-Ortega, JM (Ponce-Ortega, Jose Maria); Serna-Gonzalez, M (Serna-Gonzalez, Medardo); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

Abstract

The industrial layout traditionally has been addressed accounting for the facilities distribution and installation since the first day of operation of the plant; this is, without considering future expansions that involve additional facilities in the future operation years. This way, this paper proposes a mathematical programming formulation for the optimal facility sitting and reallocation in an industry accounting for future expansions and involving simultaneously economic and safety objectives. The proposed formulation is based on a multiannual framework and this corresponds to a multi-objective mixed integer linear programming problem. The proposed optimization approach was applied to a case study for the facility sitting (office buildings and control rooms) in an ethylene oxide plant. The economic objective function involves the minimization of the total annual cost accounting for the value of the money through the time and the safety objective function involves the minimization for the accumulated risk over the operation time. Results show the applicability of the proposed approach. (C) 2014 Elsevier Ltd. All rights reserved.
68. Ordering properties of columnar discotic triazines containing three pendant triphenylenes with four or five fluorinated tails

Umesh, CP (Umesh, C. P.); Marcelis, ATM (Marcelis, Antonius T. M.); Zuilhof, H (Zuilhof, Han)

Abstract

Two series of discotic columnar liquid crystals were prepared and investigated, consisting of a triazine core to which three triphenylenes (HATs) are attached, connected via a flexible variable spacer containing a triazole group. The triphenylenes have five pentafluoropentyloxy tails or four pentafluoropentyloxy tails and one methoxy group. The compounds with four fluorinated tails on the HAT groups show a lamellar-columnar phase (Col(lam)), whereas a compound with five fluorinated tails on the HAT groups shows a hexagonal-columnar (Col(h)) phase. Small differences in the steric properties and fluorophobic effects can therefore have a strong influence on the ordering of the molecules in the liquid crystalline phase.

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Department Name: Chemical and Materials Engineering
DSR No.: 4934
Rationally designed 1D Ag@AgVO3 nanowire/graphene/protonated g-C3N4 nanosheet heterojunctions for enhanced photocatalysis via electrostatic self-assembly and photochemical reduction methods

Zhang, SW (Zhang, Shouwei); Li, JX (Li, Jiaxing); Wang, XK (Wang, Xiangke); Huang, YS (Huang, Yongshun); Zeng, MY (Zeng, Meiyi); Xu, JZ (Xu, Jinzhang)

Abstract

1D Ag@AgVO3 nanowire/graphene/protonated g-C3N4 nanosheet (Ag@AgVO3/rGO/PCN) heterojunctions are fabricated via a simple electrostatic self-assembly process followed by a photochemical reduction method. In this hybrid structure, 1D Ag@AgVO3 nanowire penetrate through 2D nanosheets (graphene and PCN), forming a 3D hybrid photocatalyst, which is applied as an efficient visible light driven photocatalyst for organic pollutant degradation. Its enhanced photocatalytic activity is ascribed to the well-known electronic conductivity of 2D graphene, the intense visible light absorption of 1D Ag@AgVO3 nanowires, large surface areas and rapid photogenerated charge interface transfer and separation. Our results provide a facile way to fabricate hierarchical g-C3N4-based photocatalysts in a controlled manner and highlight promising prospects by adopting an integrative 1D and 2D nanomaterial strategy to design more efficient semiconductor-based composite photocatalysts with high photocatalytic activities and a wide spectral response toward environmental and energy applications.
70. Reactive extraction of phenol from aqueous solution using tri-octylamine dissolved in alkanes and alcohols

Uslu, H (Uslu, Hasan); Datta, D (Datta, Dipaloy); Bamufleh, HS (Bamufleh, Hisham S.)

Abstract

Extraction of phenol (0.053 mol kg(-1)) from wastewater is performed with trioctylamine (TOA: 0.023-0.091 mol kg-1) dissolved in four solvents (decane, octane, decan-1-ol, and octan-1-ol) at a constant temperature of 298 K. The effect of TOA concentration and type of diluent on the removal efficiency of phenol have been derived. Results show that the neutral phenol molecule is effectively extracted by TOA into the organic phase at higher concentration of TOA than lower one. The equilibrium extraction results are presented in terms of distribution coefficient (D), degree of extraction (%E) and loading ratio (Z). Maximum value of D (= 12.25) with %E = 92.45% is observed at the highest concentration of TOA (0.091 mol kg-1) with octan-1-ol. A mathematical expression for the determination of D at equilibrium is presented by applying the mass action law. This model equation is used to graphically determine the equilibrium constant (K-E) and the stoichiometric coefficient (eta) of extraction. Also, the individual equilibrium constants (K11,K21 and K-12) for the phenol TOA complexes formed are estimated from the regression of the experimental results. The highest value of complexation constant (K-E = 23) is found with TOA in octan-1-ol. Phenol molecules are extracted by TOA + decane or octane with simultaneous formation of 1:1 and 2:1 solvates, and by TOA + decan-1-ol or octan-1-ol by making 1:1 and 1:2 complexes in the organic phase. The extraction power of TOA in terms of D decreases in the order of octan-1-ol > decan-1-ol > octane > decane. 2015 Elsevier B.V. All rights reserved.
Reduction of greenhouse gas emissions from steam power plants through optimal integration with algae and cogeneration systems

Lira-Barragan, LF (Lira-Barragan, Luis Fernando); Gutierrez-Arriaga, CG (Gutierrez-Arriaga, Cesar G.); Bamufleh, HS (Bamufleh, Hisham S.); Abdelhady, F (Abdelhady, Faissal); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); Serna-Gonzalez, M (Serna-Gonzalez, Medardo); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

Abstract

This paper presents an optimization approach for mitigating CO2 emissions in the electric power generation through integrated algae and cogeneration systems. A framework is proposed for the integration of biofixation of CO2 through the cultivation of microalgae, conversion of microalgae to biodiesel, and a steam power plant with cogeneration that is thermally coupled with an industrial facility. A systematic multi-objective optimization approach is developed to integrate the considered units while simultaneously addressing technical, economic, and environmental objectives. The solution of the optimization problem is carried out via a hierarchical decomposition approach, a genetic algorithm, and the epsilon-constraint method for solving the multi-objective optimization problem. A case study is considered to integrate an existing thermoelectric power station in Mexico with an algae-and-cogeneration system. The results show that important environmental, economic, and energy benefits can be achieved as a result of the proposed integration approach.
Reprint of: Chaos synchronization of the discrete fractional logistic map

Wu, GC (Wu, Guo-Cheng); Baleanu, D (Baleanu, Dumitru)

Abstract

In this paper, master slave synchronization for the fractional difference equation is studied with a nonlinear coupling method. The numerical simulation shows that the designed synchronization method can effectively synchronize the fractional logistic map. The Caputo-like delta derivative is adopted as the difference operator. (C) 2014 Elsevier B.V. All rights reserved.
73. Review of Solid State Hydrogen Storage Methods Adopting Different Kinds of Novel Materials

Zacharia, R (Zacharia, Renju); Rather, SU (Rather, Sami Ullah)

Abstract

Overview of advances in the technology of solid state hydrogen storage methods applying different kinds of novel materials is provided. Metallic and intermetallic hydrides, complex chemical hydride, nanostructured carbon materials, metal-doped carbon nanotubes, metal-organic frameworks (MOFs), metal-doped metal organic frameworks, covalent organic frameworks (COFs), and clathrates solid state hydrogen storage techniques are discussed. The studies on their hydrogen storage properties are in progress towards positive direction. Nevertheless, it is believed that these novel materials will offer far-reaching solutions to the onboard hydrogen storage problems in near future. The review begins with the deficiencies of current energy economy and discusses the various aspects of implementation of hydrogen energy based economy.

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Reprint Address: Rather, SU (reprint author), King Abdulaziz Univ, Chem & Mat Engn Dept, POB 80204, Jeddah 21589, Saudi Arabia.
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Web of Science Categories: Nanoscience & Nanotechnology; Materials Science, Multidisciplinary
Research Areas: Science & Technology - Other Topics; Materials Science
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 7644
74. Role of Mn in supported Au-Mn/TOS catalysts
Ali, AM (Ali, A. M.); Daous, MA (Daous, M. A.); Petrov, LA (Petrov, L. A.)

Abstract
In this study, a complete catalytic propane oxidation was investigated by using four different supported Au-Mn catalytic systems. Results showed that addition of manganese to a supported gold catalyst promoted lattice oxygen activity in metal oxides, such as ceria, zirconia, and titania, which resulted in an enhanced catalytic activity of an Au-Mn catalyst because of formation of a dinuclear compound, either Au₅Mn₂ or Au₂Mn. A competition between Au and Mn to capture free lattice oxygen, dominated by manganese, was observed. In general, Ce 3d₃/₂, Au 4f₇/₂, and Mn 2p₁/₂ orbitals are related to dominant elemental species that are responsible for the enhanced catalytic activity of the Au-Mn catalyst in the complete oxidation of propane.

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Reprint Address: Petrov, LA (reprint author), King Abdulaziz Univ, SABIC Chair Catalysis, POB 80204, Jeddah 21589, Saudi Arabia.
Publisher: BULGARIAN ACAD SCIENCE
Web of Science Categories: Chemistry, Multidisciplinary
Research Areas: Chemistry
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 7437
75. Simulating the Reactions of CO2 in Aqueous Monoethanolamine Solution by Reaction Ensemble Monte Carlo Using the Continuous Fractional Component Method

Balaji, SP (Balaji, Sayee Prasaad); Gangarapu, S (Gangarapu, Satesh); Ramdin, M (Ramdin, Mahinder); Torres-Knoop, A (Torres-Knoop, Ariana); Zuilhof, H (Zuilhof, Han); Goetheer, ELV (Goetheer, Earl L. V.); Dubbeldam, D (Dubbeldam, David); Vlugt, TJH (Vlugt, Thije J. H.)

Abstract

Molecular simulations were used to compute the equilibrium concentrations of the different species in CO2 monoethanolamine solutions for different CO2 loadings. Simulations were performed in the Reaction Ensemble using the continuous fractional component Monte Carlo method at temperatures of 293, 333, and 353 K. The resulting computed equilibrium concentrations are in excellent agreement with experimental data. The effect of different reaction pathways was investigated. For a complete understanding of the equilibrium speciation, it is essential to take all elementary reactions into account because considering only the overall reaction of CO2 with MEA is insufficient. The effects of electrostatics and intermolecular van der Waals interactions were also studied, clearly showing that solvation of reactants and products is essential for the reaction. The Reaction Ensemble Monte Carlo using the continuous fractional component method opens the possibility of investigating the effects of the solvent on CO2 chemisorption by eliminating the need to study different reaction pathways and concentrate only on the thermodynamics of the system.

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Publisher: AMER CHEMICAL SOC
Web of Science Categories: Chemistry, Physical; Physics, Atomic, Molecular & Chemical
Research Areas: Chemistry; Physics
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 6127
Simultaneous design of water reusing and rainwater harvesting systems in a residential complex

Garcia-Montoya, M (Garcia-Montoya, Mariana); Bocanegra-Martinez, A (Bocanegra-Martinez, Andrea); Napoles-Rivera, F (Napoles-Rivera, Fabricio); Serna-Gonzalez, M (Serna-Gonzalez, Medardo); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

Abstract

This paper introduces an optimization formulation to design residential water systems that satisfy the water demands in a housing complex involving rainwater harvesting, storage and distribution as well as the simultaneous design of water networks for recycling, reusing, regenerating and storing reclaimed water. The design task is considered as a multi-objective optimization problem where one objective is the minimization of the fresh water consumption and the other objective is the minimization of the total annual cost. The proposed model accounts for the variability in the water demands through the different hours of the day and for the different seasons of the year. The seasonal dependence of the rainwater has also been considered in the optimization model. A case study for the city of Morelia in Mexico is presented. The results show that significant reductions can be obtained in the total fresh water consumption and in the total cost. (C) 2015 Elsevier Ltd. All rights reserved.
77. Solving fully fuzzy polynomials using feed-back neural networks

Jafarian, A (Jafarian, Ahmad); Jafari, R (Jafari, Raheleh); Golmankhaneh, AK (Golmankhaneh, Alireza Khalili); Baleanu, D (Baleanu, Dumitru)
Sorption of radionuclides from aqueous systems onto graphene oxide-based materials: a review

Yu, SJ (Yu, Shujun); Wang, XX (Wang, Xiangxue); Tan, XL (Tan, Xiaoli); Wang, XK (Wang, Xiangke)

Abstract

Graphene oxide (GO), one of the most important graphene derivatives, has many oxygen-containing functional groups on its basal plane and on the edges in the form of epoxy, hydroxyl and carboxyl groups. It has attracted increasing interest in multidisciplinary research because of its unique structure and exceptional physicochemical properties. In particular, GO-based materials have great potential in environmental remediation and energy applications. Herein, we review the recent advances in GO-based materials for the sorption of radionuclides, mainly from the last decade. This review summarizes the preparation of GO-based materials and their application in the sorption of radionuclides (such as U(VI), Eu(III), Sr(II), etc.) from aqueous systems. The main sorption mechanisms are investigated using kinetic analysis, thermodynamic analysis, surface complexation models, spectroscopic techniques and theoretical calculations. It is evident that GO-based materials have good potential for the removal of radionuclides from aqueous systems. However, it is necessary to carry out more research focusing on the development of lower cost, higher efficiency and more environmentally friendly GO-based materials, either for scientific interest or practical applications.
79. Study on gasification kinetics of hydrogen production from lignite in supercritical water

Jin, H (Jin, Hui); Guo, LJ (Guo, Liejin); Guo, J (Guo, Jian); Ge, ZW (Ge, Zhiwei); Cao, CQ (Cao, Changqing); Lu, YJ (Lu, Youjun)

Abstract

Supercritical water gasification provides a clean and efficient way to produce hydrogen from high-moisture lignite. The development of kinetic model is a demanding task for the understanding of the reaction pathway and the reactor optimization. A novel gasification kinetics model mainly concentrating on the gas products (H₂, CO, CH₄ and CO₂) was established to omit the unimportant reactions and intermediates owing to the complexity of the gasification process. Seven reactions were selected as the main routes of lignite gasification in supercritical water based on the present gasification mechanisms. The kinetics model was used to fit the experimental data obtained from the tubular reactor for continuous lignite gasification in supercritical water (operating in 560 degrees C, 25 MPa, lignite slurry concentration 5%, residence time 4.66 s-12.41 s). Rate constants were determined through minimizing the sum of the square of prediction errors. The gas product concentration as a function of time can be predicted by the model and it indicates that the concentrations of CO and CH₄ increased first and then decreased to be negligible after 30 mm. The concentrations of H₂ and CO₂ increased and remained unchanged and the fractions of H₂ and CO₂ were 65.62% and 34.29% respectively. The predictions agreed well with the thermodynamic results by minimizing Gibbs free energy. Gas formation and consumption pathways can also be predicted. Most hydrogen was produced by steam reforming reaction and consumed by methanation reaction. Copyright (c) 2014, Hydrogen Energy Publications, LLC. Published by Elsevier Ltd. All rights reserved.
80. Synthesis of Eco-Industrial Parks Interacting with a Surrounding Watershed

Lopez-Diaz, DC (Celeste Lopez-Diaz, Dulce); Lira-Barragan, LF (Lira-Barragan, Luis Fernando); Rubio-Castro, E (Rubio-Castro, Eusiel); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

Abstract

Industrial facilities impacting a watershed may be clustered into groups based on their geographical locations. Water usage and discharge for each clustered group of industries may be integrated through the introduction of an eco-industrial park (EIP). This paper presents a mathematical programming model for water integration of EIPs to be synthesized with the purpose of mitigating the environmental impact of industrial effluents discharged into watersheds. The model considers the creation of multiple EIPs, their location, sizing, and tasks. To determine the effect of the discharges on the surrounding watershed, a material flow analysis (MFA) model was coupled with water recycle strategies within the industrial facilities and the associated EIPs. The MFA characterizes the interaction of individual discharges and tracks the impact of the natural (physical, chemical, and biological) phenomena within the watershed on the fate and transport of pollutants. A multiobjective optimization formulation is developed to guide the decisions for multiplant water integration while accounting for the impact on the watershed. The objective function reconciles the minimization of the environmental impact on the watershed, the minimization of the total annualized cost of the water-management system, which includes the cost of fresh water, effluent treatment, and piping and pumping associated with the eco-industrial parks. An example is presented to show the scope and capabilities of the proposed optimization approach.
Abstract

Thermal membrane distillation (TMD) is an emerging separation method which involves simultaneous heat and mass transfer through a hydrophobic semipermeable membrane. Traditionally, studies of this technology have focused on the performance of individual modules. Because of purity and recovery requirements, multiple TMD modules may be used in various configurations including series, parallel, and combinations. Furthermore, there may be a need to reroute streams from one module to another or to recycle a stream to the same unit. The objective is to develop a systematic approach to synthesize an optimal TMD network. A structural representation is developed to embed potential configurations of interest. A mathematical formulation is developed to transform the design problem into an optimization task that seeks to minimize the cost of the system. Two case studies are presented to illustrate the applicability of the developed approach and its merit over conventional design scenarios. (c) 2014 American Institute of Chemical Engineers AIChE J, 61: 448-463, 2015
The first integral method is applied to get the different types of solutions of the (3+1)-dimensional modified Korteweg-de Vries-Zakharov-Kuznetsov and Hirota equations. We obtain envelope, bell shaped, trigonometric, and kink soliton solutions of these nonlinear evolution equations. The applied method is an effective one to obtain different types of solutions of nonlinear partial differential equations.

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Publisher : EDITURA ACAD ROMANE
Web of Science Categories : Physics, Multidisciplinary
Research Areas : Physics
Faculty Name : Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No. : 8124
The Transition States for CO2 Capture by Substituted Ethanolamines

Gangarapu, S (Gangarapu, Satesh); Marcelis, ATM (Marcelis, Antonius T. M.); Alhamed, YA (Alhamed, Yahia A.); Zuilhof, H (Zuilhof, Han)

Abstract

Quantum chemical studies are used to understand the electronic and steric effects on the mechanisms of the reaction of substituted ethanolamines with CO2. SCS-MP2/6-311+ G(2d, 2p) calculations are used to obtain the activation energy barriers and reaction energies for both the carbamate and bicarbonate formation. Implicit solvent effects are included with the universal solvation model SMD. Carbamate formation is more favorable than bicarbonate formation for monoethanolamine (MEA) both kinetically and thermodynamically. Increase of the steric hindrance on the C atoms around the N atom in substituted ethanolamines favors bicarbonate formation over carbamate formation with lower activation barriers and thereby higher reaction rates. In contrast, substitution by an N-methyl or N-ethyl group on MEA leads to a lower activation barrier for both carbamate formation and bicarbonate formation. As a result, higher reaction rates are expected as compared to MEA, and therefore these compounds have significant potential as industrial CO2 capturing solvents.
84. Tuning the chemistry of graphene oxides by a sonochemical approach: application of adsorption properties

Sun, YB (Sun, Yubing); Yang, SB (Yang, Shubin); Ding, CC (Ding, Congcong); Jin, ZX (Jin, Zhongxiu); Cheng, WC (Cheng, Wencai)

Abstract

The change in the chemical properties of graphene oxides (GOs) can be tuned by the sonochemical approach. The layers of GOs were significantly decreased by the sonochemical approach as seen from high resolution transmission electron microscopy and atomic force microscopy analysis. Abundant hydroxyl groups and carboxyl groups were introduced with increasing ultrasonic time by the analysis of Raman, FTIR, UV-vis absorbance spectroscopy and XPS techniques. The adsorption of U(VI) on GOs significantly increased at pH 1.0-6.0, whereas decreased adsorption was observed at pH > 8.0. The adsorption capacities of GOs increased with increasing ultrasonic time. According to EXAFS analysis, the interaction mechanism between radionuclides and GOs was inner-sphere surface complexation. Such an efficient approach to control the chemical properties of GOs further promotes its applications in environmental cleanup.
Ultrasensitive and ultraselective detection of H2S using electrospun CuO-loaded In2O3 nanofiber sensors assisted by pulse heating

Liang, X (Liang, Xishuang); Kim, TH (Kim, Tae-Hyung); Yoon, JW (Yoon, Ji-Wook); Kwak, CH (Kwak, Chang-Hoon); Lee, JH (Lee, Jong-Heun)

Abstract

Pure and CuO-loaded In2O3 nanofibers were prepared by electrospinning and their H2S sensing characteristics were investigated. The loading of CuO on In2O3 nanofibers significantly enhanced the gas response (ratio of the resistance in air to that in gas) toward 5 ppm H2S from 515 to 1.16 x 10(5) at 150 degrees C. The CuO-loaded In2O3 nanofibers also exhibited high gas response (9.17 x 10(3) toward 5 ppm H2S) at room temperature. The CuO-loaded In2O3 nanofibers showed ultrahigh selectivity to H2S concerning interferences with NO2, H2, CO, NH3, C2H5OH, C3H6O, TMA, C7H8, and C8H10 at room temperature and 150 degrees C. The operation of the sensor using pulse heating was suggested reliable H2S sensing with complete recovery. The ultrasensitive and ultraselective H2S sensing characteristics are explained in terms of the creation and disruption of p-n junctions in the presence and absence of H2S, respectively, the high specific surface area provided by the networks of one-dimensional polycrystalline nanofibers, and the abundance of p-n junctions due to the uniform mixing between p-CuO and n-In2O3 nanograins within the nanofibers. (C) 2014 Elsevier B.V. All rights reserved.
86. Versatile (Bio)Functionalization of Bromo-Terminated Phosphonate-Modified Porous Aluminum Oxide

Debrassi, A (Debrassi, Aline); Roeven, E (Roeven, Esther); Thijssen, S (Thijssen, Selina); Scheres, L (Scheres, Luc); de Vos, WM (de Vos, Willem M.); Wennekes, T (Wennekes, Tom); Zuilhof, H (Zuilhof, Han)

Abstract

Porous aluminum oxide (PAO) is a nanoporous material used for various (bio)technological applications, and tailoring its surface properties via covalent modification is a way to expand and refine its application. Specific and complex chemical modification of the PAO surface requires a stepwise approach in which a secondary reaction on a stable initial modification is necessary to achieve the desired terminal molecular architecture and reactivity. We here show that the straightforward initial modification of the bare PAO surface with bromo-terminated phosphonic acid allows for the subsequent preparation of PAO with a wide scope of terminal reactive groups, making it suitable for (bio)functionalization. Starting from the initial bromo-terminated PAO, we prepared PAO surfaces presenting various terminal functional groups, such as azide, alkyne, alkene, thiol, isothiocyanate, and N-hydroxysuccinimide (NHS). We also show that this wide scope of easily accessible tailored reactive PAO surfaces can be used for subsequent modification with (bio)molecules, including carbohydrate derivatives and fluorescently labeled proteins.
87. **Versatile Scope of a Masked Aldehyde Nitrone in 1,3-Dipolar Cycloadditions**

Hoogenboom, J (Hoogenboom, Jorin); Zuilhof, H (Zuilhof, Han); Wennekes, T (Wennekes, Tom)

**Abstract**

A new masked aldehyde-containing nitrone 1 that is easily available through a facile one-step procedure has been developed. It undergoes a [3 + 2]-thermal cycloaddition with a wide range of dipolarophiles, affording isoxazolidine cycloadducts that are suitable for versatile postcycloaddition modifications. The acetal cycloadducts are acid-stable, but allow for acetal hydrolysis under mildly basic conditions. The isoxazolidine ring can be opened via an efficient one-pot procedure to give amine-protected ?-alcohols that can be further converted to furanose derivatives.

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Publisher: AMER CHEMICAL SOC
Web of Science Categories: Chemistry, Organic
Research Areas: Chemistry
Faculty Name: Faculty of Engineering
Department Name: Chemical and Materials Engineering
DSR No.: 4520
Abstract

In this study, visible-light induced photocatalytic degradation of sulfa drugs (a family of synthetic antimicrobial agents), is investigated by using Ti-TUD-1/alumina photocatalyst prepared by using sol-gel method. Both photocatalytic degradation rates and formation of decontaminated products [nitrates (NO3-), ammonium (NH4+) and sulphate (SO42-) are studied. Results showed that Ti-TUD-1/alumina has very high visible-light induced photocatalytic ability as sulfa I was almost completely converted (99%) to respective decontaminated products in comparison to sulfa II and III (95% and 88%, respectively). Sulfa I and III depicted higher degradation rates at low pH opposite to sulfa II which had higher catalytic degradation rates at higher pH. A reverse relationship between initial sulfa compounds concentration and reaction rate exits. Visible-light induced photocatalytic cracking of S-N bond of sulfa compound is one of the initial degradation pathways along with structure of each sulfa compound.
DEPARTMENT OF
CIVIL ENGINEERING
1. A NEW SPATIAL MULTIPLE DISCRETE-CONTINUOUS MODELING APPROACH TO LAND USE CHANGE ANALYSIS

Bhat, CR (Bhat, Chandra R.); Dubey, SK (Dubey, Subodh K.); Bin Alam, MJ (Bin Alam, Mohammad Jobair); Khushefati, WH (Khushefati, Waleed H.)

Abstract

This paper formulates a multiple discrete-continuous probit (MDCP) land use model within a spatially explicit economic structural framework for land use change decisions. The spatial MDCP model is capable of predicting both the type and intensity of urban development patterns over large geographic areas, while also explicitly acknowledging geographic proximity-based spatial dependencies in these patterns. At a methodological level, the paper focuses on specifying and estimating a spatial MDCP model that allows the dependent variable to exist in multiple discrete states with an intensity associated with each discrete state. The formulation also accommodates spatial dependencies, as well as spatial heterogeneity and heteroskedasticity, in the dependent variable, and should be applicable in a wide variety of fields where social and spatial dependencies between decision agents (or observation units) lead to spillover effects in multiple discrete-continuous choices (or states). A simulation exercise is undertaken to evaluate the ability of the proposed maximum approximate composite marginal likelihood (MACML) approach to recover parameters from a cross-sectional spatial MDCP model. The results show that the MACML approach does well in recovering parameters. An empirical demonstration of the approach is undertaken using the city of Austin parcel level land use data.

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Publisher: WILEY-BLACKWELL
Web of Science Categories: Economics; Environmental Studies; Planning & Development
Research Areas: Business & Economics; Environmental Sciences & Ecology; Public Administration
Faculty Name: Faculty of Engineering
Department Name: Civil Engineering
DSR No.: 4778
2. A novel viscoplastic model of high-density polyethylene pipe material

Siddiquee, MSA (Siddiquee, M. S. A.); Dhar, AS (Dhar, A. S.)

Abstract

A nonlinear three-component elastic viscoplastic strain-rate-dependent model was developed for a high-density polyethylene pipe material. In this model, the stress at any point is assumed to be a unique function of the instantaneous irreversible strain, its rate and acceleration, irrespective of any intermediate stress and strain history. However, a reference strain rate was assumed and below this the response was independent of the strain rate. Parameters of the model were determined using published data on strain-rate-dependent material responses. The model was developed within the elasto-viscoplastic framework so that it could be used in solving boundary value problems. The return mapping algorithm of strain-rate-dependent elasto-plastic material is described with the detailed derivation of the consistent tangent operator for quadratic convergence. The model was successfully implemented in an existing finite-element code. Finite-element analyses using this model were capable of simulating the strain-rate-dependent stress-strain relation, the response to a jump in the strain rate and an unloading-reloading response for a high-density polyethylene pipe material published in the literature.
3. **A pressure-sensitive kinematic hardening model incorporating Masing's law**

**Siddiquee, MSA (Siddiquee, Mohammed Saiful Alam)**

**Abstract**

A model is proposed to simulate the stress-strain behavior of sands subjected to cyclic loads in general three-dimensional stress space. A novel formulation is developed using Prager's kinematic hardening rule and extending the one-dimensional Masing's rule to general three-dimensional stress space. The hysteretic stress-strain curves are constructed based on skeleton curves. In order to do this, the Masing's rule is generalized to the proportional rule, which consists of two sets of rules: the internal and external rule. Subsequently, a drag rule is introduced to simulate cyclic stress-strain behavior in which the stress amplitude increases at a decreasing rate during cyclic loading with a constant strain amplitude. The dimensionless kinematic hardening rate is assumed to depend on the current stress value along the stress path. When the direction of loading is reversed, the initial rate of hardening is restored. The rate of variation of hardening is scaled according to an extended Masing's law. As a result, a closed hysteretic stress-strain loop is obtained during cyclic loading.
4. **Assessment and analysis of wind power resource using weibull parameters**

Bassyouni, M (Bassyouni, M.); Gutub, SA (Gutub, Saud A.); Javaid, U (Javaid, Umair); Awais, M (Awais, Muhammad); Rehman, S (Rehman, Shafiqur); Abdel-Hamid, SMS (Abdel-Hamid, S. M. -S); Abdel-Aziz, MH (Abdel-Aziz, M. H.); Abouel-Kasem, A (Abouel-Kasem, A.); Shafeek, H (Shafeek, Hani)

**Abstract**

In this study, wind data of eleven years (2002-2012) has been used to determine wind characteristics of Saudi Arabian city Jeddah. These characteristics include the daily, monthly and annual wind speed, wind probability density distribution, shape (k) and scale (c) parameters at 10 m height. The analysis revealed that yearly values of k ranged from 1.398 to 1.763 with a mean value of 1.590 and values of scale parameter c varied from 3.146 to 4.329 with mean value of 3.95. Furthermore, the results showed that maximum and minimum wind power potential was observed in the month of March and February, respectively. The wind was found to be blowing predominantly from south east direction. It was found that wind potential of the region can be used for small scale off-grid wind applications.
5. Behavior of fresh and hardened concretes with antifreeze admixtures in deep-freeze low temperatures and exterior winter conditions

Karagol, F (Karagol, Fatma); Demirboga, R (Demirboga, Ramazan); Khushefati, WH (Khushefati, Waleed H.)

Abstract

This research investigates properties of concrete prepared with urea and calcium nitrate anti-freeze admixtures and cured in different low deep-freeze temperatures and exterior winter conditions in Erzurum, Turkey. Four different mixtures were prepared and they are control, 9% calcium nitrate, 9% urea and combination of 4.5% urea + 4.5% calcium nitrate. Antifreeze admixtures were used by weight of cement dosage. After casting, one group of samples from each batch were immediately cured in four different low deep-freeze temperatures (-5, -10, -15 and -20 degrees C) for 7, 28, 90 and 365 days (90 days deepfreeze curing + 275 days laboratory condition). Another group of samples was cured in water (23 +/- 2) degrees C for 7, 28, 90 and 365 (90 days water curing + 275 days laboratory condition) days, according to ASTM C 192. The others were exposed to exterior winter conditions of Erzurum, Turkey, for 90 and 365 days. Ultrasonic pulse velocity (UPV) and compressive strength were evaluated for 7, 28, 90 and 365 days. Both compressive strength and UPV were very low for -15 and -20 degrees C at 7 and 28 days of curing durations, especially for control and samples containing 9% urea. However, with the increase of curing period, both compressive strength and UPV values of samples with the combination of 4.5% urea + 4.5% calcium nitrate increased. Adding 4.5% calcium nitrate and 4.5% urea caused an increment in the compressive strength of about 108% and 82% for 90 and 365 days in exterior winter conditions, respectively, when compared to the compressive strength of control sample that was exposed to the same conditions. (C) 2014 Elsevier Ltd. All rights reserved.
6. Computational simulation of time-dependent behavior of soil-structure interaction by using a novel creep model: Application to a geosynthetic-reinforced soil physical model

Siddiquee, MSA (Siddiquee, Mohammed Saiful Alam); Noguchi, T (Noguchi, T.); Hirakawa, D (Hirakawa, D.)

Abstract

In this paper, a model geosynthetic-reinforced soil retaining walls (GRS-RW) is tested by vertically loading it through a rough footing on the top near the retaining wall and the results are simulated by a sophisticated nonlinear Finite Element Method (FEM) having a novel rate dependent constitutive model for both the backfill material and the geosynthetic reinforcement. Usually, polymer geosynthetic reinforcement is known to exhibit more-or-less rate-dependent stress-strain or load-strain behavior due to their viscous properties. The geomaterials (i.e., clay, sand, gravel and soft rock) also exhibit viscous properties. The viscous behavior of geomaterials are quite different from that of the polymer based geosynthetic-reinforcements. It has been revealed recently that viscous behavior of sand is a kind of temporary effect, which vanishes with time. So the rate-dependent deformation of backfill reinforced with polymer geosynthetic reinforcement becomes highly complicated due to interactions between the elasto-viscoplastic properties of backfill and reinforcement. In the present study, a scaled model geosynthetic-reinforced soil retaining wall is tested with a vertically loaded rough rigid footing. The results of the model test are simulated by using an appropriate elasto-viscoplastic constitutive model of both sand and geogrid embedded in a nonlinear plane strain FEM. (C) 2015 Elsevier Ltd. All rights reserved.

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Publisher : ELSEVIER SCI LTD
Web of Science Categories : Computer Science, Interdisciplinary Applications; Engineering, Geological; Geosciences, Multidisciplinary
Research Areas : Computer Science; Engineering; Geology
Faculty Name : Faculty of Engineering
Department Name : Civil Engineering
DSR No. : 6441
Degradation of a broad spectrum of trace organic contaminants by an enzymatic membrane reactor: Complementary role of membrane retention and enzymatic degradation

Nguyen, LN (Nguyen, Luong N.); Hai, FI (Hai, Faisal I.); Price, WE (Price, William E.); Kang, JG (Kang, Jinguo); Leusch, FDL (Leusch, Frederic D. L.); Roddick, F (Roddick, Felicity); van de Merwe, JP (van de Merwe, Jason P.); Magram, SF (Magram, Saleh F.); Nghiem, LD (Nghiem, Long D.)

Abstract

Laccase-catalysed degradation of 30 trace organic contaminants (TrOCs) with diverse chemical structure was investigated in an enzymatic membrane reactor (EMR) equipped with an ultrafiltration membrane. Compared to the results from batch incubation tests, the EMR could facilitate degradation of some phenolic and a number of non-phenolic TrOCs. Laccase, which was completely retained by the membrane, formed a dynamic gel layer on the membrane surface onto which TrOCs were adsorbed. EMR investigations with active and heat-inactivated laccase confirmed that the TrOCs retained by the active laccase gel layer were eventually degraded. Redox-mediator addition to the EMR significantly extended the spectrum of efficiently degraded TrOCs, but a limited improvement was observed in batch tests. The results demonstrate the important role of TrOC retention by the enzyme gel layer dynamically formed on the membrane in achieving improved degradation of TrOCs by the mediator-assisted laccase system. Despite following the same hydrogen atom transfer pathway, the mediators tested (syringaldehyde and 1-hydroxybenzotriazole) exhibited TrOC-specific degradation improvement capacity. (C) 2014 Elsevier Ltd. All rights reserved.
Abstract

In this paper, five pedestrian level of service (PLOS) methods are outlined in brief with respect to their assets and their limitations: (a) the Australian method, (b) the Highway Capacity Manual 2010 method, (c) the trip quality method, (d) the Landis method, and (e) the Tan Dandan method. In this study, each method was implemented to consider its suitability for use in Dhaka City, Bangladesh, through the integration of objective measurement and subjective assessment. The objective measurement consisted of a determination of the PLOS of five study locations in Dhaka City and the adoption of field data on traffic, geometric, and environmental factors. The subjective assessment had its basis in a user perception rating by 50 individuals of the service quality of pedestrian facilities in the selected study areas. A separate survey of 415 individuals was conducted to identify the most favored of 25 service quality attributes extracted from the five PLOS methods. The perception ratings were scrutinized to identify any potential deviations that arose from participant age and gender. In the ratings, the Australian method prevailed over the other four methods with a score of 18. The trip quality method scored second best with 16 points. The separate survey substantiated the adequacy of the Australian method for use in Dhaka City and included seven of the eight most desired and popular PLOS attributes selected by the survey respondents. Future research should be devoted to the development of a new PLOS method that uses the factors identified in this paper.
Development of a sequential Artificial Neural Network for predicting river water levels based on Brahmaputra and Ganges water levels

Siddiquee, MSA (Siddiquee, Mohammed Saiful Alam); Hossain, MMA (Hossain, Mollah Md Awlad)

Abstract

Bangladesh is land of rivers with about 700 km shoreline at the Bay of Bengal. More than 300 rivers flow over the land of Bangladesh having an area of about 1,47,000 km². A wide part of this country frequently face flood hazard caused by the excessive flow from three major rivers named the Ganges, the Brahmaputra and the Meghna due to heavy monsoon rainfalls on the upstream catchment area. The control of water flow is an international issue shared among Bangladesh, Nepal and India. Among 57 trans-boundary rivers, 54 enter into Bangladesh from India. Seasonal flood management is a regular exercise and costly event in Bangladesh. Among the several tools of flood management, flood forecasting is a major non-structural measure to protect the people and property from the damage of flood. Hence, the water experts of Bangladesh use several water models to assess the flood. All those are hydrodynamic models based on the mathematical framework of the elliptic differential equations. The hydrodynamic models require huge and reliable data to run the model and predict the flood elevations at river cross sections ahead of time. The models are complex and require calibration and validation for geophysical and morphological changes of river cross sections. Flood Forecast Warning Cell forecasts the flood levels during the monsoon period in more than 80 locations spread over the Bangladesh in major rivers which are generated based on boundary water levels at the Ganges, Brahmaputra and estimated rainfalls using rainfall runoff and river models. In order to circumvent the scarcity of reliable and accurate hydrological data, reduce run time and to make faster and simpler flood level prediction, this research investigated a method of using Artificial Neural Network (ANN) to generate the water levels along the rivers at selected locations. The proposed ANN can predict the incoming flood properly using boundary water levels at Bahadurabad in Brahmaputra and at Harding Bridge in the Ganges. The developed ANN has been given the name as 'Bangladesh River Artificial Neural Network System' and used to provide an early flood warning system.

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Reprint Address: Siddiquee, MSA (reprint author), King Abdulaziz Univ, Coll Engn, Dept Civil Engn, Jeddah 21413, Saudi Arabia.
Publisher: SPRINGER
Web of Science Categories: Computer Science, Artificial Intelligence
Research Areas: Computer Science
Faculty Name: Faculty of Engineering
Department Name: Civil Engineering
DSR No.: 4822
10. Development of high strength alkali activated binder using palm oil fuel ash and GGBS at ambient temperature

Salih, MA (Salih, Moslih Amer); Farzadnia, N (Farzadnia, Nima); Ali, AAA (Ali, Abang Abdullah Abang); Demirboga, R (Demirboga, Ramazan)

Abstract

This study focused on production of high strength alkali activated binder by alkali activation of binary mix of palm oil fuel ash (POFA) and ground granulated blast furnace slag (GGBS) at ambient temperature. Compression test was performed to assess mechanical properties of the mixture. Chemical tests were also conducted to investigate the role of calcium and aluminum ions from GGBS in the strength development. Formation of aluminum-substituted calcium silicate hydrate (C-A-S-H) gel with a higher degree of crystallinity was observed when GGBS was added. Replacement of 50% POFA with GGBS increased the strength up to 92 MPa at 90 days. (C) 2015 Elsevier Ltd. All rights reserved.
11. Effect of different curing temperatures on alkali activated palm oil fuel ash paste

Salih, MA (Salih, Moslih Amer); Farzadnia, N (Farzadnia, Nima); Ali, AAA (Ali, Abang Abdullah Abang); Demirboga, R (Demirboga, Ramazan)

Abstract

This study investigated effects of curing temperature on alkali activation of palm oil fuel ash. Compression test was conducted on samples activated with a mixture of sodium silicate and sodium hydroxide at different curing temperatures; ambient, 60 degrees C, 70 degrees C, and 80 degrees C. Also, XRD, TGA, FEW, and SEM/EDX tests were performed to trace changes due to geopolymerization. Results showed that the ambient temperature can be applied to activate mixes with 100% POFA. Compressive strength of up to 36.8 MPa was obtained when samples cured at ambient temperature. The threshold temperature for activation of POFA was 70 degrees C. (C) 2015 Elsevier Ltd. All rights reserved.
12. Effects of elevated temperature on pumice based geopolymer composites

Yadollahi, MM (Yadollahi, M. M.); Benli, A (Benli, A.); Demirboga, R (Demirboga, R.)

Abstract

Aluminosilicate type materials can be activated in alkaline environment and can produce geopolymer cements with low environmental impacts. Geopolymers are believed to provide good fire resistance so the effects of elevated temperatures on mechanical and microstructural properties of pumice based geopolymer were investigated in this study. Pumice based geopolymer was exposed to elevated temperatures of 100, 200, 300, 400, 500, 600, 700 and 800 degrees C for 3 h. The residual strength of these specimens were determined after cooling at room temperature as well as ultrasonic pulse velocity, and the density of pumice based geopolymer pastes before and after exposing to high temperature was determined. Microstructures of these samples were investigated by Fourier transform infrared for all temperatures and SEM analyses for samples that were exposed to 200, 400, 600 and 800 degrees C. Specimens, which were initially grey, turned whitish accompanied by the appearance of cracks as temperatures increased to 600 and 800 degrees C. Consequently, compressive strength losses in geopolymer paste were increased with increasing temperature level. On the other hand, compressive strength of geopolymer paste was less affected by high temperature in comparison with the ordinary Portland cement. As a result of this study, it is concluded that pumice based geopolymer is useful in compressive strength losses exposed to elevated temperatures.

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Document Type: Article
Reprint Address: Benli, A (reprint author), Bingol Univ, Dept Civil Engn, Bingol, Turkey.
Publisher: MANEY PUBLISHING
Web of Science Categories: Materials Science, Composites; Polymer Science
Research Areas: Materials Science; Polymer Science
Faculty Name: Faculty of Engineering
Department Name: Civil Engineering
DSR No.: 5861
13. Effects of nano and micro size of CaO and MgO, nano-clay and expanded perlite aggregate on the autogenous shrinkage of mortar

Polat, R (Polat, Riza); Demirboga, R (Demirboga, Ramazan); Khushefati, WH (Khushefati, Waleed H.)

Abstract

When the water-to-binder ratio is lower than a critical value, a considerable self-desiccation may occur, leading to autogenous shrinkage (AS). This volume change can induce internal stresses when the shrinkage is restricted, and may cause micro cracks, endangering the durability of the cement based composites. It is essential to find appropriate ways to avoid such a risk of cracking at early ages. Methods based on the concept of internal concrete curing, expansive additives have been suggested in the literature. This paper focuses on the reduction of AS by both methods for the same mix proportions of the mortars to compare their effects. Thus, the effects of different percentages of pre-saturated expanded perlite aggregate (EPA), micro and nano size MgO, CaO and smectite (based) nano clays on AS of the mortars are discussed and compared. The highest reduction was observed for mixes containing 7.5% CaO and nano-MgO and resulting in a reduction of the autogenous shrinkage by 80%, at 28 days. However, reduction obtained by nano-CaO was negligible. EPA replacement of 30% of the fine aggregate reduced AS by 68% at 28 days. (c) 2015 Elsevier Ltd. All rights reserved.
14. Numerical simulation of bare soil water and heat flow under an automated irrigation system

Ahmed, MH (Ahmed, Mohamed H.); Gutub, S (Gutub, Saud)

Abstract

Modern irrigation techniques use automated systems where irrigation schedules are controlled according to certain criteria. The objective of this study is to numerically estimate irrigation events, water content and temperature distributions, evaporation, drainage, and soil water under closed loop automated irrigation systems of a bare soil. The automated irrigation system is activated and deactivated according to the water content value. The governing equations for transient one-dimensional liquid water flow and heat transfer of unsaturated porous media are applied. The energy balance equation at the soil surface is used as an upper boundary condition based on measured meteorological data of Jeddah City. The results show that the current procedure can be applied to simulate different variables under automated irrigation systems. The water content shows periodic behavior, as well as time lags and decreases in amplitude with soil depth. The timing of applied irrigation has an important impact on evaporation and soil temperature. Applying irrigation water during the daytime leads to increased evaporation. The soil surface temperature decreases suddenly when water is supplied in the afternoon, while a slight increase is observed when irrigation is applied at midnight.

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Publisher: IWA PUBLISHING
Web of Science Categories: Water Resources
Research Areas: Water Resources
Faculty Name: Faculty of Engineering
Department Name: Civil Engineering
DSR No.: 4643
15. Production and applications of crude polyhydroxyalkanoate-containing bioplastic from the organic fraction of municipal solid waste

Ivanov, V (Ivanov, V.); Stabnikov, V (Stabnikov, V.); Ahmed, Z (Ahmed, Z.); Dobrenko, S (Dobrenko, S.); Saliuk, A (Saliuk, A.)

Abstract

A considerable economic and environmental need exists for the further development of degradable plastic polyhydroxyalkanoates (PHAs), which are produced by bacteria. However, the production cost of this bioplastic, manufactured using conventional technologies, is several times higher than that of petrochemical-based plastics. This is a major obstacle for the industrial production of PHA bioplastic for non-medical use. The aim of this review is to evaluate suitable methods for the significant reduction in bioplastic production costs. The study findings are as follows: (1) The organic fraction of municipal solid waste can be used as a raw material through acidogenic fermentation; (2) non-aseptic cultivation using mixed bacterial culture can significantly reduce the production cost; (3) biotechnology of bacterial cultivation should ensure selection of PHA-accumulating strains; (4) applications of PHA-containing material in both construction industry and agriculture do not require expensive extraction of PHAs from bacterial biomass. The implementation of the above findings in the current manufacturing process of PHA-containing bioplastic would significantly reduce production costs, thereby rendering PHA-containing bioplastic an economically viable and environmentally friendly alternative to petrochemical-based plastics.

Sources

: INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY

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Reprint Address : Ivanov, V (reprint author), Iowa State Univ, Dept Civil Construct & Environm Engn, Ames, IA 50011 USA.
Publisher : SPRINGER
Web of Science Categories : Environmental Sciences
Research Areas : Environmental Sciences & Ecology
Faculty Name : Faculty of Engineering
Department Name : Civil Engineering
DSR No. : 7277
16. Relationship between compressive strength and UPV of GGBFS based geopolymer mortars exposed to elevated temperatures

Omer, SA (Omer, Sharmarke Abdi); Demirboga, R (Demirboga, Ramazan); Khushefati, WH (Khushefati, Waleed H.)

Abstract

Geopolymers are innovative materials possessing properties similar to normal OPC, while having less environmental impact. The current research was conducted on GGBFS based geopolymeric mortars. The effects of sodium silicate to sodium hydroxide ratio on the compressive strength of the mortars at 1 and 7 days before and after exposure to the elevated temperatures of 200 degrees C, 400 degrees C, 600 degrees C, and 800 degrees C were investigated. Additionally, the relationship between Ultrasonic Pulse Velocity (UPV) and compressive strength was investigated for before and after exposure to elevated temperatures. It was found that the sodium silicate to sodium hydroxide ratio had little or no effect on the compressive strength change between 1 and 7 days. However, the compressive strength generally increased with increasing sodium silicate content. Similar trend was observed for elevated temperature exposure, in that the strength increased with increasing sodium silicate to sodium hydroxide ratio, while the overall behavior was such that the compressive strength decreased as the temperature exposure increased. UPV measurements showed similar behavior, which indicated that relationship between UPV and compressive strength was exponential and R-2 was between 0.95 and 0.98. (C) 2015 Elsevier Ltd. All rights reserved.
17. Study of Black Sand Particles from Sand Dunes in Badr, Saudi Arabia Using Electron Microscopy

Khwaja, HA (Khwaja, Haider Abbas); Aburizaiza, OS (Aburizaiza, Omar Siraj); Hershey, DL (Hershey, Daniel L.); Siddique, A (Siddique, Azhar); Guerrieri, PEDA (Guerrieri, David A. P. E.); Zeb, J (Zeb, Jahan); Abbass, M (Abbass, Mohammad); Blake, DR (Blake, Donald R.); Hussain, MM (Hussain, Mirza Mozammel); Aburiziza, AJ (Aburiziza, Abdullah Jameel); Kramer, MA (Kramer, Malissa A.); Simpson, IJ (Simpson, Isobel J.)

Abstract

Particulate air pollution is a health concern. This study determines the microscopic make-up of different varieties of sand particles collected at a sand dune site in Badr, Saudi Arabia in 2012. Three categories of sand were studied: black sand, white sand, and volcanic sand. The study used multiple high resolution electron microscopies to study the morphologies, emission source types, size, and elemental composition of the particles, and to evaluate the presence of surface coatings or contaminants deposited or transported by the black sand particles. White sand was comprised of natural coarse particles linked to wind-blown releases from crustal surfaces, weathering of igneous/metamorphic rock sources, and volcanic activities. Black sand particles exhibited different morphologies and microstructures (surface roughness) compared with the white sand and volcanic sand. Morphological Scanning Electron Microscopy (SEM) and Laser Scanning Microscopy (LSM) analyses revealed that the black sand contained fine and ultrafine particles (50 to 500 nm ranges) and was strongly magnetic, indicating the mineral magnetite or elemental iron. Aqueous extracts of black sands were acidic (pH = 5.0). Fe, C, O, Ti, Si, V, and S dominated the composition of black sand. Results suggest that carbon and other contaminant fine particles were produced by fossil-fuel combustion and industrial emissions in heavily industrialized areas of Haifa and Yanbu, and transported as cloud condensation nuclei to Douf Mountain. The suite of techniques used in this study has yielded an in-depth characterization of sand particles. Such information will be needed in future environmental, toxicological, epidemiological, and source apportionment studies.

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Language : English
Document Type : Article
Reprint Address : Khwaja, HA (reprint author), New York State Dept Hlth, Wadsworth Ctr, Albany, NY 12201 USA.
Publisher : MDPI AG
Web of Science Categories : Meteorology & Atmospheric Sciences
Research Areas: Meteorology & Atmospheric Sciences
Faculty Name: Faculty of Engineering
Department Name: Civil Engineering
DSR No.: 5561
18. The effects of silica modulus and aging on compressive strength of pumice-based geopolymer composites

Yadollahi, MM (Yadollahi, Mehrzad Mohabbi); Benli, A (Benli, Ahmet); Demirboga, R (Demirboga, Ramazan)

Abstract

The environmental impact of Portland cement is significant. In the procedure of cement production, production of one ton cement releases about one ton CO2 in environment. To enhance material greenness and produce alternative binders as a geopolymer, the physical and mechanical properties of Hasankale based pumice geopolymer has been discussed in this study and to identify the best geopolymer mix ratios, varying silica modulus (Ms = SiO2/Na2O), water/binder (w/b) and Na2O content have been investigated via trial and error approach. Hence nine series of geopolymer pastes differing in Na2O content (4%, 7% and 10%), silica modulus (0.52, 0.6 and 0.68) and w/b ratios (0.36, 0.40 and 0.44) were manufactured to activating Hasankale based ground pumice in this study. The test results indicated that the mix with Ms = 0.68, Na2O = 0.10%, w/b = 0.36 gave the higher compressive strength approximately 40 Mpa. These test results indicated that the produced geopolymers compressive strength were high enough and can be used as a structural material. Turkey is one of the richest countries in terms of pumice resources in the world. Regarding to the reduction of necessary energy to produce Portland cement, it is expected to have economic benefit too. (C) 2015 Elsevier Ltd. All rights reserved.
DEPARTMENT: OF

ELECTRICAL AND COMPUTER ENGINEERING
1. 1.55-mu m mode-locked quantum-dot lasers with 300 MHz frequency tuning range

Sadeev, T (Sadeev, T.); Arsenijevic, D (Arsenijevic, D.); Franke, D (Franke, D.); Kreissl, J (Kreissl, J.); Kunzel, H (Kuenzel, H.); Bimberg, D (Bimberg, D.)

Abstract

Passive mode-locking of two-section quantum-dot mode-locked lasers grown by metalorganic vapor phase epitaxy on InP is reported. 1250-mu m long lasers exhibit a wide tuning range of 300 MHz around the fundamental mode-locking frequency of 33.48 GHz. The frequency tuning is achieved by varying the reverse bias of the saturable absorber from 0 to -2.2V and the gain section current from 90 to 280 mA. 3 dB optical spectra width of 6-7 nm leads to ex-facet optical pulses with full-width half-maximum down to 3.7 ps. Single-section quantum-dot mode-locked lasers show 0.8 ps broad optical pulses after external fiber-based compression. Injection current tuning from 70 to 300 mA leads to 30 MHz frequency tuning.

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Language : English
Document Type : Article
Reprint Address : Sadeev, T (reprint author), Tech Univ Berlin, Inst Festkorperphys, D-10623 Berlin, Germany.
Publisher : AMER INST PHYSICS
Web of Science Categories : Physics, Applied
Research Areas : Physics
Faculty Name : Faculty of Engineering
Department Name : Electrical and Computer Engineering
DSR No. : 7354
2. 230 s room-temperature storage time and 1.14 eV hole localization energy in In0.5Ga0.5As quantum dots on a GaAs interlayer in GaP with an AlP barrier

Bonato, L (Bonato, Leo); Sala, EM (Sala, Elisa M.); Stracke, G (Stracke, Gernot); Nowozin, T (Nowozin, Tobias); Strittmatter, A (Strittmatter, Andre); Ajour, MN (Ajour, Mohammed Nasser); Daqrouq, K (Daqrouq, Khaled); Bimberg, D (Bimberg, Dieter)

Abstract

A GaP n(+)p-diode containing In0.5Ga0.5As quantum dots (QDs) and an AlP barrier is characterized electrically, together with two reference samples: a simple n(+)p-diode and an n(+)p-diode with AlP barrier. Localization energy, capture cross-section, and storage time for holes in the QDs are determined using deep-level transient spectroscopy. The localization energy is 1.14(+/-0.04) eV, yielding a storage time at room temperature of 230(+/-60)s, which marks an improvement of 2 orders of magnitude compared to the former record value in QDs. Alternative material systems are proposed for still higher localization energies and longer storage times. (C) 2015 AIP Publishing LLC.
3. 3-Dimensional advanced solution for lunar descent and landing

Mehedi, IM (Mehedi, Ibrahim Mustafa); Kubota, T (Kubota, Takashi); Al-Saggaf, UM (Al-Saggaf, Ubaid M.)

Abstract

A 3-dimensional advanced guidance scheme is necessary to perform a successful precise lunar landing mission. This paper outlines a 3-dimensional comparison of different methods of solution of motion control equations for guidance scheme of lunar descent. It also proposes a 3-dimensional advanced solution that allows a full depiction for a descent vehicle motion from orbital states down to the final landing event. In the conventional 2-dimensional methods of solution, some inadequate assumptions exist that limit the validity of the solutions. The proposed research solves those problems and eventually allows a complete representation of the descent module motion for successful pinpoint lunar landing.
4. 40 Gbit/s data transmission with 980 nm VCSELs at 120 degrees C using four-level pulse-amplitude modulation

Wolf, P (Wolf, P.); Lott, JA (Lott, J. A.); Arsenijevic, D (Arsenijevic, D.); Moser, P (Moser, P.); Li, H (Li, H.); Bimberg, D (Bimberg, D.)

Abstract

Temperature-stable oxide-confined 980 nm vertical-cavity surface-emitting lasers for optical interconnects are presented. For the first time 40 Gbit/s 4-PAM data transmission is experimentally demonstrated at temperatures of 100 and 120 degrees C.
5. A Compact Ultra-wideband MIMO Antenna with Improved Isolation

Syed, A (Syed, Avez); Aldhaheri, RW (Aldhaheri, Rabah W.)

Abstract

A compact printed MIMO antenna with an area of 18.7 mm x 45.2 mm and an impedance bandwidth of 129% (based on -10 dB criteria) is presented for UWB applications. The antenna consists of two identical patch elements which are placed on the same substrate with a rectangular microstrip patch in between. The inclusion of microstrip patch improves the isolation and maintains the overall mutual coupling of less than -21 dB (-26 dB in most of the band) over the entire UWB band. The proposed antenna operates over the frequency band ranging from 2.8 GHz to 13 GHz which covers the entire UWB bandwidth with stable radiation patterns. The return loss and the isolation of the antenna are obtained using HFSS simulator.


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Reprint Address: Syed, A (reprint author), King Abdulaziz Univ, Dept Elect & Comp Engn, Jeddah 21589, Saudi Arabia.
Publisher: IEEE
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 7493
6. A comparative study on modelling material removal rate by ANFIS and polynomial methods in electrical discharge machining process

Al-Ghamdi, K (Al-Ghamdi, Khalid); Taylan, O (Taylan, Osman)

Abstract

Due to the controversy associated with modelling Electrical Discharge Machining (EDM) processes based on physical laws; this task is predominantly accomplished using empirical modelling methods. The modelling studies reported in the literature deal predominantly with quantitative parameters i.e. ones with numerical levels. In fact, modelling categorical parameters has been devoted a scant attention. This study reports the results of an EDM experiment conducted on the Ti-6Al-4V alloy. Its aim was to model the relationship between the Material Removal Rate (MRR) and the parameters of the process, namely, current, pulse on-time and pulse off-time along with a categorical factor (electrode material). The modelling process was accomplished using adaptive neuro-fuzzy inference system (ANFIS) and polynomial modelling approaches. In fact, one purpose of this study was to compare the performance of these modelling approaches as no study was found contrasting their prediction capability in the literature. Regarding the polynomial model, two numerical parameters (current and pulse on-time) were declared significant in the ANOVA together with the electrode material and its interaction with pulse on-time. Thus, they were all incorporated in the developed polynomial model. Furthermore, five ANFIS models with 6, 9, 19, 21 and 51 rules were developed utilizing the first order Sugeno fuzzy approach by back-propagation neural networks training algorithm. Of these, the ANFIS model with 21 rules was the best. This model also outperformed the polynomial model remarkably in terms of predicting error, residuals range and the correlation coefficient between the experimental and predicted MRR values. The study sheds light on the powerful learning capability of ANFIS models and its superiority over the conventional polynomial models in terms of modelling complex non-linear machining processes. (C) 2014 Elsevier Ltd. All rights reserved.
A Competent Memetic Algorithm for Learning Fuzzy Cognitive Maps

Acampora, G (Acampora, Giovanni); Pedrycz, W (Pedrycz, Witold); Vitiello, A (Vitiello, Autilia)

Abstract

Fuzzy cognitive maps (FCMs) form an important class of models for describing and simulating the behavior of dynamic systems through causal reasoning. Owing to their abilities to make the symbolic knowledge processing simple and transparent, FCMs have been successfully used to model the behavior of complex systems originating from numerous application areas, such as economy, politics, medicine, and engineering. However, the design of FCMs necessarily involves domain experts to develop a graph-based model composed of a collection of system's concepts and causal relationships among them. Consequently, since humans exhibit an intrinsic factor of subjectivity and are only able to efficiently develop small-size graph-based models, there is a legitimate need to devise methods capable of automatically learning FCM models from data. This research addresses this need by introducing a competent memetic algorithm to generate FCM models from available historical data, with no human intervention. Extensive benchmarking tests performed on both synthetic and real-world data quantify the performance of the competent memetic method and emphasize its suitability over the models obtained by conventional and noncompetent hybrid evolutionary approaches in terms of accuracy, approximation ability, and convergence speed. Moreover, the proposed approach is shown to be scalable due to its capability to efficiently learn high-dimensional FCM models.

Salem, MA (Salem, Mohamed A.); Caloz, C (Caloz, Christophe)

Abstract

Eigenfunction expansion of the free-space dyadic Green function using vector spherical wave functions is shown to be incomplete when the source is not located at the origin. Such incompleteness may result in inaccurate field computation. To resolve this issue, we present a complete eigenfunction set using the Kontorovich-Lebedev transform. This expansion set is employed to compute the electromagnetic field radiated by a circular current loop and verified by comparison with full-wave simulation.


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Reprint Address: Salem, MA (reprint author), Polytech Montreal, Dept Elect Engn, Montreal, PQ H2T 1J3, Canada.
Publisher: IEEE
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 7489
9. **A decision support system to develop a quality management in academic digital libraries**

Cabrero, FJ (Javier Cabrerizo, Francisco); Morente-Molinera, JA (Antonio Morente-Molinera, Juan); Perez, IJ (Javier Perez, Ignacio); Lopez-Gijon, J (Lopez-Gijon, Javier); Herrera-Viedma, E (Herrera-Viedma, Enrique)

**Abstract**

Academic digital libraries are getting more benefit from the Web possibilities to help with teaching, learning and research activities. Because of it, more and more people use the services that they offer. Therefore, it is very important that the academic digital libraries provide a good service in order to satisfy the users' expectations. The aim of this paper is to present a decision support system assisting the staff of the academic digital libraries to make decisions in order to meet the users' needs and, in such a way, to increase the number of users utilizing them. To do so, the decision support system is composed of several decision rules which generate recommendations according to both objective and subjective criteria to improve the quality of the services offered by the academic digital libraries. (C) 2015 Elsevier Inc. All rights reserved.

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**Research Areas**: Computer Science  
**Faculty Name**: Faculty of Engineering  
**Department Name**: Electrical and Computer Engineering  
**DSR No.**: 4476

Azri, M (Azri, Maaspaliza); Abd Rahim, N (Abd Rahim, Nasrudin); Abd Halim, W (Abd Halim, Wahidah)

Abstract

In this article, the performance of the split-capacitor H-bridge topology as a single-phase transformerless photovoltaic inverter is studied. By connecting the midpoint of its two series DC-link capacitors to the ground, the split-capacitor H-bridge is able to clamp the common-mode voltage of the system, effectively suppressing leakage ground current. To overcome the issue of capacitor voltage balancing, a simple balancing circuit and its control are introduced. The operation modes, common-mode voltage, and leakage ground current characteristics of the split-capacitor H-bridge topology are discussed, subsequently validated using both simulation and experimental tests. Comparison with a conventional transformerless H-bridge topology proves the superiority of the split-capacitor H-bridge topology in terms of leakage ground current and efficiency.
11. A Human-Computer Cooperation Fuzzy c-Means Clustering with Interval-Valued Weights

Lu, W (Lu, Wei); Zhang, LY (Zhang, Liyong); Liu, XD (Liu, Xiaodong); Yang, JH (Yang, Jianhua); Pedrycz, W (Pedrycz, Witold)

Abstract

In this paper, a fuzzy c-means clustering algorithm based on interval-valued weights is proposed for improving clustering performance. In the proposed algorithm, the interval-valued weights are first constructed by synergy of the ReliefF algorithm and the analytic hierarchy process (AHP) method, and then they are transformed into a constraint condition associating with each weight variable in the weighted clustering objective function. In the sequence, the weighted clustering objective function is solved by combining the Lagrange multiplier method with the gradient-based iteration computation. In the whole process of algorithm iteration, a compulsion strategy with human-computer cooperation is adopted to ensure each weight variable satisfies interval constraint itself. Three well-known data set are used to perform profound experiments. Experimental results clearly show that the proposed algorithm has better clustering performance than other the weighted fuzzy c-means clustering algorithm. (C) 2014 Wiley Periodicals, Inc.
A HYBRID MODEL FOR DECISION-MAKING IN THE INFORMATION AND COMMUNICATIONS TECHNOLOGY SECTOR

Cid-Lopez, A (Cid-Lopez, Andres); Hornos, MJ (Hornos, Miguel J.); Carrasco, RA (Alberto Carrasco, Ramon); Herrera-Viedma, E (Herrera-Viedma, Enrique)

Abstract

The majority of businesses in the Information and Communications Technology (ICT) sector face decision-making problems on a daily basis. Most of these problems are based on contexts of uncertainty, where decisions are founded on qualitative information which may be imprecise or perception-based. In these cases, the information which is expressed by experts and users of evaluated services can be treated using processes of computing with words (CW). In this paper, we present a hybrid decision-making model especially designed for the ICT sector whereby the experts have the support of an intelligent system which provides information about the opinions of users related to those problems which are to be analysed. These opinions are obtained by using different mechanisms and techniques when users conduct business with the service provider. In addition, we employ a procedure for obtaining consensus between experts which enriches and strengthens the decision-making process.
13. A modified differential evolution based maximum power point tracker for photovoltaic system under partial shading condition

Ramli, MAM (Ramli, Makbul A. M.); Ishaque, K (Ishaque, Kashif); Jawaid, F (Jawaid, Faizan); Al-Turki, YA (Al-Turki, Yusuf A.); Salam, Z (Salam, Zainal)

Abstract

This work proposes a modified differential evolution (MDE) based maximum power point tracker (MPPT) for photovoltaic (PV) system under partial shading condition. The proposed MDE does not involve any random numbers; hence, consistency of MPP tracking always prevails. Besides, it only contains one tuning parameter, i.e., mutation factor, which significantly simplifies the implementation strategy and therefore a low-cost micro-controller can be used for its realization. Despite the simpler MPPT structure, for each tested shaded curve, MDE always converges toward the global MPP within 12 perturbations. Performance wise, it outperforms another evolutionary algorithm, namely particle swarm optimization (PSO), which frequently traps at local MPP in shading conditions. The proposed MDE also works accurately for the measured data profile of a tropical country during 9.00 am to 5.00 pm, where it attains 99.5% average tracking efficiency. (C) 2015 Elsevier B.V. All rights reserved.
14. A New Hybrid Algorithm for Bankruptcy Prediction Using Switching Particle Swarm Optimization and Support Vector Machines

Lu, Y (Lu, Yang); Zeng, NY (Zeng, Nianyin); Liu, XH (Liu, Xiaohui); Yi, SJ (Yi, Shujuan)

Abstract

Bankruptcy prediction has been extensively investigated by data mining techniques since it is a critical issue in the accounting and finance field. In this paper, a new hybrid algorithm combining switching particle swarm optimization (SPSO) and support vector machine (SVM) is proposed to solve the bankruptcy prediction problem. In particular, a recently developed SPSO algorithm is exploited to search the optimal parameter values of radial basis function (RBF) kernel of the SVM. The new algorithm can largely improve the explanatory power and the stability of the SVM. The proposed algorithm is successfully applied in the bankruptcy prediction problem, where experiment data sets are originally from the UCI Machine Learning Repository. The simulation results show the superiority of proposed algorithm over the traditional SVM-based methods combined with genetic algorithm (GA) or the particle swarm optimization (PSO) algorithm alone.
15. A NOVEL UWB RECTANGULAR SLOT DISK MONOPOLE ANTENNA WITH BAND-NOTCH CHARACTERISTICS

Aldhaheri, RW (Aldhaheri, Rabah W.); Babu, KJ (Babu, Kamili Jagadeesh); Syed, A (Syed, Avez); Sheikh, MM (Sheikh, Muntasir M.)

Abstract

In this article, a simple, low cost, and compact-printed monopole ultrawideband (UWB) antenna with band-notch characteristics is proposed. The antenna operates from 3 to 11.2 GHz covering the UWB band (3.1-10.6 GHz), while rejecting the frequency band 5.15-5.825 GHz, which is limited by IEEE 802.11a. The proposed antenna has a small size of 26 x 31 mm(2) and is designed on an FR4 substrate with permittivity (epsilon(r)) 4.5 having a thickness of 1.52 mm. A parametric study is performed to understand the effects of antenna parameters on its performance. A good agreement between simulated and measured results is also observed. (C) 2015 Wiley Periodicals, Inc.
16. A probabilistic approach for designing nonlinear optimal robust tracking controllers for unmanned aerial vehicles

Giacomin, PAS (Giacomin, Paulo Andre S.); Hemerly, EM (Hemerly, Elder Moreira); Pedrycz, W (Pedrycz, Witold)

Abstract

In this study, we propose a probabilistic approach for designing nonlinear optimal robust tracking controllers for unmanned aerial vehicles. The controller design is formulated in terms of a multi-objective optimization problem that is solved by using a bio-inspired optimization algorithm, offering high likelihood of finding an optimal or near-optimal global solution. The process of tuning the controller minimizes differences between system outputs and optimal specifications given in terms of rising time, overshoot and steady-state error, and the controller succeed in fitting the performance requirements even considering parametric uncertainties and the nonlinearities of the aircraft. The stability of the controller is proved for the nominal case and its robustness is carefully verified by means of Monte Carlo simulations. (C) 2015 Elsevier B.V. All rights reserved.
17. A Review of Ferroresonance in Capacitive Voltage Transformer
Abu Bakar, A (Abu Bakar, Ab Halim); Khan, SA (Khan, Shakil Ahamed); Kwang, TC (Kwang, Tan Chia); Abd Rahim, N (Abd Rahim, Nasrudin)

Abstract
Ferroresonance incidences in electrical power system have been commonly regarded as unexplained phenomenon, which is not critical for utility engineers. As a result, research conducted in this area is limited and the awareness on ferroresonance is relatively low among utility engineers. However, as the electrical system evolves, its complexity increases in line with the increasing risk of ferroresonance. As a result, this paper provides a consolidated review on the research conducted on ferroresonance to highlight its importance. This paper covers the fundamental inductor-capacitor pair for ferroresonance initiation and the modes of ferroresonance, followed by ferroresonance in capacitive voltage transformer (CVT), constituting its impact, initiation, and suppression techniques. The core focus in this paper is ferroresonance in CVT due to switching events, on which the documented literature is very scarce. (c) 2014 Institute of Electrical Engineers of Japan. Published by John Wiley & Sons, Inc.

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18. A rule-based development of incremental models

Li, JB (Li, Jinbo); Pedrycz, W (Pedrycz, Witold); Wang, XM (Wang, Xianmin)

Abstract

In the study, we propose a concept of incremental fuzzy models in which fuzzy rules are aimed at compensating discrepancies resulting because of the use of a certain global yet simple model of general nature (such as e.g., a constant or linear regression). The structure of input data and error discovered through fuzzy clustering is captured in the form of a collection of fuzzy clusters, which helps eliminate (compensate) error produced by the global model. We discuss a detailed architecture of the proposed rule-based model and present its design based on an augmented version of Fuzzy C-Means (FCM). An extended suite of experimental studies offering some comparative analysis is covered as well. (C) 2015 Elsevier Inc. All rights reserved.
19. Study on Relationship Between Generalization Abilities and Fuzziness of Base Classifiers in Ensemble Learning

Wang, XZ (Wang, Xi-Zhao); Xing, HJ (Xing, Hong-Jie); Li, Y (Li, Yan); Hua, Q (Hua, Qiang); Dong, CR (Dong, Chun-Ru); Pedrycz, W (Pedrycz, Witold)

Abstract

We investigate essential relationships between generalization capabilities and fuzziness of fuzzy classifiers (viz., the classifiers whose outputs are vectors of membership grades of a pattern to the individual classes). The study makes a claim and offers sound evidence behind the observation that higher fuzziness of a fuzzy classifier may imply better generalization aspects of the classifier, especially for classification data exhibiting complex boundaries. This observation is not intuitive with a commonly accepted position in "traditional" pattern recognition. The relationship that obeys the conditional maximum entropy principle is experimentally confirmed. Furthermore, the relationship can be explained by the fact that samples located close to classification boundaries are more difficult to be correctly classified than the samples positioned far from the boundaries. This relationship is expected to provide some guidelines as to the improvement of generalization aspects of fuzzy classifiers.
20. A Survey on Multisensor Fusion and Consensus Filtering for Sensor Networks

Li, WY (Li, Wangyan); Wang, ZD (Wang, Zidong); Wei, GL (Wei, Guoliang); Ma, LF (Ma, Lifeng); Hu, J (Hu, Jun); Ding, DR (Ding, Derui)

Abstract

Multisensor fusion and consensus filtering are two fascinating subjects in the research of sensor networks. In this survey, we will cover both classic results and recent advances developed in these two topics. First, we recall some important results in the development of multisensor fusion technology. Particularly, we pay great attention to the fusion with unknown correlations, which ubiquitously exist in most of distributed filtering problems. Next, we give a systematic review on several widely used consensus filtering approaches. Furthermore, some latest progress on multisensor fusion and consensus filtering is also presented. Finally, conclusions are drawn and several potential future research directions are outlined.
21. A unique in vivo approach for investigating antimicrobial materials utilizing fistulated animals

Berean, KJ (Berean, Kyle J.); Adetutu, EM (Adetutu, Eric M.); Ou, JZ (Ou, Jian Zhen); Nour, M (Nour, Majid); Nguyen, EP (Nguyen, Emily P.); Paull, D (Paull, David); Mcleod, J (Mcleod, Jess); Ramanathan, R (Ramanathan, Rajesh); Bansal, V (Bansal, Vipul); L

Abstract

Unique in vivo tests were conducted through the use of a fistulated ruminant, providing an ideal environment with a diverse and vibrant microbial community. Utilizing such a procedure can be especially invaluable for investigating the performance of antimicrobial materials related to human and animal related infections. In this pilot study, it is shown that the rumen of a fistulated animal provides an excellent live laboratory for assessing the properties of antimicrobial materials. We investigate microbial colonization onto model nanocomposites based on silver (Ag) nanoparticles at different concentrations into polydimethylsiloxane (PDMS). With implantable devices posing a major risk for hospital-acquired infections, the present study provides a viable solution to understand microbial colonization with the potential to reduce the incidence of infection through the introduction of Ag nanoparticles at the optimum concentrations. In vitro measurements were also conducted to show the validity of the approach. An optimal loading of 0.25 wt% Ag is found to show the greatest antimicrobial activity and observed through the in vivo tests to reduce the microbial diversity colonizing the surface.

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Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
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22. Active fault tolerant control of buildings for seismic loads in finite frequency domain

Zhu, BH (Zhu, Bohao); Lin, WY (Lin, Weiyang); Zhan, Q (Zhan, Qian); Sun, WC (Sun, Weichao); Hayat, T (Hayat, Tasawar); Alsaadi, F (Alsaadi, Fuad)

Abstract

This paper deals with the problem of vibration suppression for seismic-excited buildings in finite frequency domain, and the possible faults caused by actuators are also considered in controller's design to improve the stability of the system. Firstly, with the consideration of seismic wave's effect, a mathematical model of building structure system is established. Then the finite frequency theory is introduced to the process of controller design in order to reduce seismic-excited building vibration over a certain frequency band and enhance disturbance suppression performance. Furthermore, taking actuators' faults into account, the active fault tolerance control method is also added to the finite frequency domain controller to compensate for the faults effect and remain the performance of building system at an acceptable level when faults occur. Finally, simulation of a three-degree-of-freedom linear building structure under earthquake excitation is given to illustrate the effect of the proposed approach.
23. Adaptive B-spline neural network based nonlinear equalization for high-order QAM systems with nonlinear transmit high power amplifier

Chen, S (Chen, Sheng); Hong, X (Hong, Xia); Khalaf, E (Khalaf, Emad); Morfeq, A (Morfeq, Ali); Alotaibi, ND (Alotaibi, Naif D.)

Abstract

High bandwidth-efficiency quadrature amplitude modulation (QAM) signaling widely adopted in high-rate communication systems suffers from a drawback of high peak-to-average power ratio, which may cause the nonlinear saturation of the high power amplifier (HPA) at transmitter. Thus, practical high-throughput QAM communication systems exhibit nonlinear and dispersive channel characteristics that must be modeled as a Hammerstein channel. Standard linear equalization becomes inadequate for such Hammerstein communication systems. In this paper, we advocate an adaptive B-Spline neural network based nonlinear equalizer. Specifically, during the training phase, an efficient alternating least squares (LS) scheme is employed to estimate the parameters of the Hammerstein channel, including both the channel impulse response (CIR) coefficients and the parameters of the B-spline neural network that models the HPA's nonlinearity. In addition, another B-spline neural network is used to model the inversion of the nonlinear HPA, and the parameters of this inverting B-spline model can easily be estimated using the standard LS algorithm based on the pseudo training data obtained as a natural byproduct of the Hammerstein channel identification. Nonlinear equalisation of the Hammerstein channel is then accomplished by the linear equalization based on the estimated CIR as well as the inverse B-spline neural network model. Furthermore, during the data communication phase, the decision-directed LS channel estimation is adopted to track the time-varying CIR. Extensive simulation results demonstrate the effectiveness of our proposed B-Spline neural network based nonlinear equalization scheme. (C) 2015 Elsevier Inc. All rights reserved.

Liu, L (Liu, Liang); Yin, S (Yin, Shen); Gao, HJ (Gao, Huijun); Alsaadi, F (Alsaadi, Fuad); Hayat, T (Hayat, Tasawar)

Abstract

This paper aims to solve the adaptive stabilization problem for a class of stochastic high-order nonlinear systems with stochastic inverse dynamics and nonlinear parameterization. Under the weaker assumptions on stochastic inverse dynamic and nonlinear functions, by generalizing the adding a power integrator technique, using the idea of changing supply function and parameter separation technique, a smooth adaptive partial-state feedback controller is constructed to render the closed-loop system globally stable in probability and all states can be regulated to the origin almost surely. The effectiveness of the designed controller is demonstrated by a simulation example. (C) 2014 Elsevier Ltd. All rights reserved.
### Abstract

Montmorillonite (Mt) was used to remove copper (Cu²⁺) ion from wastewater stream generated from industrial effluents. This clay was modified (Mt-TOA) by using an amine-based solvent, trioctylamine (TOA). Equilibrium and kinetic experiments were carried out to determine the effect of adsorbent amount (w, 0.05 g to 0.3 g for Mt, 0.001 to 0.006 g for MtTOA), initial Cu²⁺ ion concentration (C₀, 8 mg.L⁻¹ to 16 mg.L⁻¹), pH (2 to 10), and contact time (t, 10 to 90 min) on the capacity of both adsorbents. With an increase in the adsorbent amount, the uptake capacity of Mt and Mt-TOA for Cu²⁺ ion was found to decrease but with an enhancement in the removal efficiency. The optimum amount of Mt and Mt-TOA was found to be 0.1 and 0.001 g, respectively. A better adsorption of Cu²⁺ ion was observed at low pH value of aqueous solution, and was found to decrease with an increase in the value of pH. In the kinetic experiments, the amount removal of Cu²⁺ ion reached to a constant value of 75.62 % with Mt (0.1 g) and 80.12 % with Mt-TOA (0.001 g) after 70 min. Equilibrium and kinetic data were analyzed by using eight different isotherm (Langmuir, Freundlich, Elovich, Temkin, Dubinin-Radushkevich, Redlich-Peterson, Toth, and Sips) and two different kinetic (pseudo-first-order and pseudo-second-order) models, respectively.
Almost sure H-infinity filtering for nonlinear hybrid stochastic systems with mode-dependent interval delays
Shu, HS (Shu, Huisheng); Yang, H (Yang, Hua); Wang, ZD (Wang, Zidong); Alsaadi, FE (Alsaadi, Fuad E.); Hayat, T (Hayat, Tasawar)

Abstract

In this paper, the problem of almost sure H-infinity filtering is studied for a class of nonlinear hybrid stochastic systems. In the system under investigation, Markovian jumping parameters, mode-dependent interval delays, nonzero exogenous disturbances as well as white noises are simultaneously taken into consideration to better model the real-world systems. Intensive stochastic analysis is carried out to obtain sufficient conditions for ensuring the almost surely exponential stability and the prescribed H-infinity performance for the overall filtering error dynamics. Furthermore, the obtained results are applied to two classes of special hybrid stochastic systems with mode-dependent interval delays, where the desired filter gain is obtained in terms of the solutions to a set of linear matrix inequalities. Finally, two numerical examples are provided to show the effectiveness of the proposed filter design scheme. (C) 2015 The Franklin Institute. Published by Elsevier Ltd. All rights reserved.
27. An expansion of fuzzy information granules through successive refinements of their information content and their use to system modeling

Balamash, A (Balamash, Abdullah); Pedrycz, W (Pedrycz, Witold); Al-Hmouz, R (Al-Hmouz, Rami); Morfeq, A (Morfeq, Ali)

Abstract

This study is concerned with a fundamental problem of expanding (refining) information granules being treated as functional entities playing a pivotal role in Granular Computing and ensuing constructs such as granular models, granular classifiers, and granular predictors. We formulate a problem of refinement of information granules as a certain optimization task in which a selected information granule is refined into a family of more detailed (precise, viz, more specific) information granules so that a general partition requirement becomes satisfied. As the ensuing information granules are directly linked with the more general information granule positioned at the higher level of hierarchy, the partition criterion is conditional by being implied (conditioned) by the description of the granule positioned one level up in the hierarchy. A criterion guiding a refinement of information granules is formulated and made fully reflective of the nature of the problem (being of regression-like or of classification character), which leads to a distinct way in which the diversity of information granules is articulated and quantified. With regard to the detailed algorithmic setting, we discuss the use of a so-called conditional Fuzzy C-Means and show how information granules (fuzzy sets) are formed in a successive manner. The method helps highlight the ensuing calculations of the resulting membership functions and reveal how the detailed structure of the data is captured. A number of numeric studies in the realm of system modeling are provided to demonstrate the performance of the approach and highlight the nature of the resulting information granules along with the performance of the fuzzy models in which these information granules are used. (C) 2014 Elsevier Ltd. All rights reserved.
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 6501
28. An extended VIKOR method based on prospect theory for multiple attribute decision making under interval type-2 fuzzy environment

Qin, JD (Qin, Jindong); Liu, XW (Liu, Xinwang); Pedrycz, W (Pedrycz, Witold)

Abstract

Interval type-2 fuzzy set (IT2FS) offers interesting avenue to handle high order information and uncertainty in decision support system (DSS) when dealing with both extrinsic and intrinsic aspects of uncertainty. Recently, multiple attribute decision making (MADM) problems with interval type-2 fuzzy information have received increasing attentions both from researchers and practitioners. As a result, a number of interval type-2 fuzzy MADM methods have been developed. In this paper, we extend the VIKOR (VIseKriterijumska Optimizacija I Kompromisno Resenje, in Serbian) method based on the prospect theory to accommodate interval type-2 fuzzy circumstances. First, we propose a new distance measure for IT2FS, which is comes as a sound alternative when being compared with the existing interval type-2 fuzzy distance measures. Then, a decision model integrating VIKOR method and prospect theory is proposed. A case study concerning a high-tech risk evaluation is provided to illustrate the applicability of the proposed method. In addition, a comparative analysis with interval type-2 fuzzy TOPSIS method is also presented. (C) 2015 Elsevier B.V. All rights reserved.
Abstract

This study investigates a new biobjective lane-reservation problem, which is to exclusively reserve lanes from an existing transportation network for special transport tasks with given deadlines. The objectives are to minimize the total negative impact on normal traffic due to the reduction of available lanes for general-purpose vehicles and to maximize the robustness of the lane-reservation solution against the uncertainty in link travel times. We first define the robustness for the lane-reservation problem and formulate a biobjective mixed-integer linear program. Then, we develop an improved exact epsilon-constraint and a cut-and-solve combined method to generate its Pareto front. Computational results for an instance based on a real network topology and 220 randomly generated instances with up to 150 nodes, 600 arcs, and 50 tasks demonstrate that the proposed method is able to find the Pareto front and that the proposed cut-and-solve method is more efficient than the direct use of optimization software CPLEX.
Abstract

This paper aims to establish a unified framework to handle both the exponential synchronization and state estimation problems for a class of nonlinear singularly perturbed complex networks (SPCNs). Each node in the SPCN comprises both "slow" and "fast" dynamics that reflect the singular perturbation behavior. General sector-like nonlinear function is employed to describe the nonlinearities existing in the network. All nodes in the SPCN have the same structures and properties. By utilizing a novel Lyapunov functional and the Kronecker product, it is shown that the addressed SPCN is synchronized if certain matrix inequalities are feasible. The state estimation problem is then studied for the same complex network, where the purpose is to design a state estimator to estimate the network states through available output measurements such that dynamics (both slow and fast) of the estimation error is guaranteed to be globally asymptotically stable. Again, a matrix inequality approach is developed for the state estimation problem. Two numerical examples are presented to verify the effectiveness and merits of the proposed synchronization scheme and state estimation formulation. It is worth mentioning that our main results are still valid even if the slow subsystems within the network are unstable.
31. An Investigation of Wavelet Average Framing LPC for Noisy Speaker Identification Environment

Daqrouq, K (Daqrouq, Khaled); Al-Hmouz, R (Al-Hmouz, Rami); Balamash, AS (Balamash, Abdullah Saeed); Alotaibi, N (Alotaibi, Naif); Noeth, E (Noeth, Elmar)

Abstract

In the presented research paper, an average framing linear prediction coding (AFLPC) method for a text-independent speaker identification system is studied. AFLPC was proposed in our previous work. Generally, linear prediction coding (LPC) has been used in numerous speech recognition tasks. Here, an investigative procedure was based on studying the AFLPC speaker recognition system in a noisy environment. In the stage of feature extraction, the speaker-specific resonances of the vocal tract were extracted using the AFLPC technique. In the phase of classification, a probabilistic neural network (PNN) and Bayesian classifier (BC) were applied for comparison. In the performed investigation, the quality of different wavelet transforms with AFLPC techniques was compared with each other. In addition, the capability analysis of the proposed system was examined for comparison with other systems suggested in the literature. In response to an achieved experimental result in a noisy environment, the PNN classifier could have a better performance with the fusion of wavelets and AFLPC as a feature extraction technique termed WFALPCF.

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32. **Analysis of Discontinuity Induced Bifurcations in a Dual Input DC-DC Converter**

Giaouris, D (Giaouris, Damian); Banerjee, S (Banerjee, Soumitro); Mandal, K (Mandal, Kuntal); Al-Hindawi, MM (Al-Hindawi, Mohammed M.); Abusorrah, A (Abusorrah, Abdullah); Al-Turki, Y (Al-Turki, Yusuf); El Aroudi, A (El Aroudi, Abdelali)

**Abstract**

DC-DC power converters with multiple inputs and a single output are used in numerous applications where multiple sources, e.g. two or more renewable energy sources and/or a battery, feed a single load. In this work, a classical boost converter topology with two input branches connected to two different sources is chosen, with each branch independently being controlled by a separate peak current mode controller. We demonstrate for the first time that even though this converter is similar to other well known topologies that have been studied before, it exhibits many complex nonlinear behaviors that are not found in any other standard PWM controlled power converter. The system undergoes period incrementing cascade as a parameter is varied, with discontinuous hard transitions between consecutive periodicitities. We show that the system can be described by a discontinuous map, which explains the observed bifurcation phenomena. The results have been experimentally validated.

**Sources**

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DSR No. : 6351
33. **Analysis of renewable energy feed-in tariffs in selected regions of the globe: Lessons for Saudi Arabia**

Ramli, MAM (Ramli, Makbul A. M.); Twaha, S (Twaha, Ssennoga)

**Abstract**

In this paper, an analysis of renewable energy feed-in tariffs (REFIT) for the selected regions of the globe is done with the aim of drawing lesson for Saudi Arabia. A brief background and status of renewable energy sources (RES) utilization in Saudi Arabia is given at the beginning of this paper, followed by a review of the feed-in tariff (FIT) design models reported in literature. The application of the policy in Europe, the United States, Australia, Asia and Africa is then reviewed. Some observations from the analysis of the FIT application in different countries have been discussed and finally, lessons have been drawn from the study. Some policy recommendations have been given for Saudi Arabia. The analysis of the lessons identified shows that the application of FIT scheme in Saudi Arabia is likely to speed up the development of renewable energy resources within the area. (C) 2015 Elsevier Ltd. All rights reserved.
34. Application of Wavelet Transform for PDZ Domain Classification

Daqrouq, K (Daqrouq, Khaled); Alhmouz, R (Alhmouz, Rami); Balamesh, A (Balamesh, Ahmed); Memic, A (Memic, Adnan)

Abstract

PDZ domains have been identified as part of an array of signaling proteins that are often unrelated, except for the well-conserved structural PDZ domain they contain. These domains have been linked to many disease processes including common Avian influenza, as well as very rare conditions such as Fraser and Usher syndromes. Historically, based on the interactions and the nature of bonds they form, PDZ domains have most often been classified into one of three classes (class I, class II and others - class III), that is directly dependent on their binding partner. In this study, we report on three unique feature extraction approaches based on the bigram and trigram occurrence and existence rearrangements within the domain's primary amino acid sequences in assisting PDZ domain classification. Wavelet packet transform (WPT) and Shannon entropy denoted by wavelet entropy (WE) feature extraction methods were proposed. Using 115 unique human and mouse PDZ domains, the existence rearrangement approach yielded a high recognition rate (78.34%), which outperformed our occurrence rearrangements based method. The recognition rate was (81.41%) with validation technique. The method reported for PDZ domain classification from primary sequences proved to be an encouraging approach for obtaining consistent classification results. We anticipate that by increasing the database size, we can further improve feature extraction and correct classification.

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Research Areas : Science & Technology - Other Topics
Faculty Name : Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No. : 6512
Approximation grid evaluation-based PID control in cascade with nonlinear gain

Dong, RJ (Dong, Ruijun); Pedrycz, W (Pedrycz, Witold)

Abstract

The main disadvantage of standard PID type controllers is the absence of self-tuning features. The PID parameters are expected to vary either as operating condition or dynamics of the system vary or at different phases of control process with intent to develop an optimal strategy. The purpose of this study is to overcome the existing disadvantage by using a cunningly chosen nonlinear gain. The novelty of the study associates with a sound choice of the best form of nonlinear gains to impact the performance of a PID controller when being coupled with the cascade nonlinear gain (known as NPID). An approximation grid evaluation of NPID controller used in a feedback control problem is proposed. This eliminates a technical restriction when using previous nonlinear variation evaluation. The evaluated forms cover a broad range of popular variants. To the practicing control engineers who prefer to realize an effective NPID control, the proposed approach highlights the potential to make a reasonable selection of the nonlinear gain functions without requiring any additional process information. (C) 2015 The Franklin Institute. Published by Elsevier Ltd. All rights reserved.
36. Arrhythmia Classification Based on Novel Distance Series Transform of Phase Space Trajectories

Sayed, KS (Sayed, Khaled S.); Khalaf, AF (Khalaf, Aya F.); Kadah, YM (Kadah, Yasser M.)

Abstract

Cardiac arrhythmia is a serious disorder in heart electrical activity that may have fatal consequences especially if not detected early. This motivated the development of automated arrhythmia detection systems that can early detect and accurately recognize arrhythmias thus significantly improving the chances of patient survival. In this paper, we propose an improved arrhythmia detection system particularly designed to identify five different types based on nonlinear dynamical modeling of electrocardiogram signals. The new approach introduces a novel distance series domain derived from the reconstructed phase space as a transform space for the signals that is explored using classical features. The performance measures showed that the proposed system outperforms state of the art methods as it achieved 98.7% accuracy, 99.54% sensitivity, 99.42% specificity, 98.19% positive predictive value, and 99.85% negative predictive value.


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DSR No.: 7476
37. **Artificial Neural Network Analysis for Modeling Fibril Structure in Bone**

Khaterchi, H (Khaterchi, Houda); Chamekh, A (Chamekh, Abdessalem); BelHadjSalah, H (BelHadjSalah, Hedi)

**Abstract**

The bone as seen hierarchically is a structured material with mechanical properties depending on several scales. We will focus our study here on the fibril scale which is formed essentially by collagen and mineral. In order to find the macroscopic properties of the fibril we have proposed a multiscale approach. From finite element simulation performed on a unit cell, an Artificial Neural Network (ANN) model is developed in order to identify, the material properties of the fibril. The advantage of this method is that it can be used to define the equivalent properties of a class of parameterized unit cells.

**Sources**

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<th>Source</th>
<th>INTERNATIONAL JOURNAL OF PRECISION ENGINEERING AND MANUFACTURING</th>
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**Reprint Address**

Khaterchi, H (reprint author), Univ Monastir, Natl Engn Sch Monastir, Mech Engn Lab, Monastir 5019, Tunisia.

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Engineering, Manufacturing; Engineering, Mechanical

**Research Areas**

Engineering

**Faculty Name**

Faculty of Engineering

**Department Name:**

Electrical and Computer Engineering

**DSR No.**

6958
38. Bifurcation behaviors of synchronized regions in logistic map networks with coupling delay

Tang, LK (Tang, Longkun); Wu, XQ (Wu, Xiaoqun); Lu, JH (Lu, Jinhu); Lu, JA (Lu, Jun-an)

Abstract

Network synchronized regions play an extremely important role in network synchronization according to the master stability function framework. This paper focuses on network synchronous state stability via studying the effects of nodal dynamics, coupling delay, and coupling way on synchronized regions in Logistic map networks. Theoretical and numerical investigations show that (1) network synchronization is closely associated with its nodal dynamics. Particularly, the synchronized region bifurcation points through which the synchronized region switches from one type to another are in good agreement with those of the uncoupled node system, and chaotic nodal dynamics can greatly impede network synchronization. (2) The coupling delay generally impairs the synchronizability of Logistic map networks, which is also dominated by the parity of delay for some nodal parameters. (3) A simple nonlinear coupling facilitates network synchronization more than the linear one does. The results found in this paper will help to intensify our understanding for the synchronous state stability in discrete-time networks with coupling delay. (C) 2015 AIP Publishing LLC.

Sources: CHAOS
ISO Source Abbrev: Chaos
Impact Factor: 2.049
Year: 2015
Volume: 25
Issue: 3
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Language: English
Document Type: Article
Reprint Address: Tang, LK (reprint author), Huaqiao Univ, Sch Math Sci, Quanzhou 362021, Peoples R China.
Publisher: AMER INST PHYSICS
Web of Science Categories: Mathematics, Applied; Physics, Mathematical
Research Areas: Mathematics; Physics
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 6886
39. **Birefringent "Generalized Refractive" Metasurface**

Achouri, K (Achouri, Karim); Salem, MA (Salem, Mohamed A.); Caloz, C (Caloz, Christophe)

**Abstract**

A birefringent "generalized refractive" metasurface is synthesized for the first time. This metasurface independently refracts electromagnetic waves with different polarizations to arbitrary directions. The synthesis is performed using a general technique that models the metasurface, assumed to be subwavelength in thickness, by a zero-thickness meta-sheet characterized by electromagnetic susceptibility tensors. As an illustration, a metasurface refracting orthogonally polarized Gaussian beams normally incident on the metasurface to two different directions, without reflection, is demonstrated.

**Sources**


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2015

**Pages**

878-879

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**Cited reference count**

29

**Language**

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**Document Type**

Proceedings Paper

**Reprint Address**

Achouri, K (reprint author), Polytech Montreal, Dept Elect Engn, Montreal, PQ H2T 1J3, Canada.

**Publisher**

IEEE

**Faculty Name**

Faculty of Engineering

**Department Name:**

Electrical and Computer Engineering

**DSR No.**

7485
40. Bit-Error-Rate (BER) Performance in Dispersion Code Multiple Access (DCMA)

Gupta, S (Gupta, Shulabh); Zou, LF (Zou, Lianfeng); Salem, MA (Salem, Mohamed A.); Caloz, C (Caloz, Christophe)

Abstract

The bit-error-rate (BER) performance of a 5 x 5 dispersion code multiple access system (DCMA) is numerically investigated assuming Chebyshev dispersion group delay coding. It is found that odd Chebyshev coding features lower BER than even Chebyshev coding between dispersion matched pairs within the DCMA system. This is the first study of a full DCMA communication system.
41. Building and managing fuzzy ontologies with heterogeneous linguistic information

Morente-Molinera, JA (Morente-Molinera, J. A.); Perez, IJ (Perez, I. J.); Urena, MR (Urena, M. R.); Herrera-Viedma, E (Herrera-Viedma, E.)

Abstract

Fuzzy ontologies allow the modeling of real world environments using fuzzy sets mathematical environment and linguistic modeling. Therefore, fuzzy ontologies become really useful when the information that is worked with is imprecise. This happens a lot in real world environments because humans are more used to think using imprecise nature words instead of numbers. Furthermore, there is a high amount of concepts that, because of their own nature, cannot be measured numerically. Moreover, due to the fact that linguistic information is extracted from different sources and is represented using different linguistic term sets, to deal with it can be problematic. In this paper, three different novel approaches that can help us to build and manage fuzzy ontologies using heterogeneous linguistic information are proposed. Advantages and drawbacks of all of the new proposed approaches are exposed. Thanks to the use of multi-granular fuzzy linguistic methods, information can be expressed using different linguistic term sets. Multi-granular fuzzy linguistic methods can also allow users to choose the linguistic term sets that they prefer to formulate their queries. In such a way, user-computer communication is improved since users feel more comfortable when using the system. (C) 2015 Elsevier B.V. All rights reserved.
42. Capacitively Loaded Loop-Based Antennas with Reconfigurable Radiation Patterns

Dakhli, S (Dakhli, Saber); Rmili, H (Rmili, Hatem); Floc’h, JM (Floc’h, Jean-marie); Sheikh, M (Sheikh, Muntasir); Mahdjoubi, K (Mahdjoubi, Kourosh); Choubani, F (Choubani, Fethi); Ziolkowski, RW (Ziolkowski, Richard W.)

Abstract

A class of metamaterial-inspired antennas having reconfigurable radiation patterns is proposed. They consist of a driven monopole antenna with one-and two-capacitively loaded loop (CLL), near field resonant parasitic elements. Two configurations are studied by considering the state of these CLL elements as being either open or closed configurations. Simulation results explain the design features and demonstrate that the structure can change its beam direction simply by controlling the switched states. Two prototypes with one-and two-CLL elements were fabricated and tested. The measured impedance mismatch and radiation pattern results are presented and compared to the corresponding simulated values.

Sources:
ISO Source Abbrev: INTERNATIONAL JOURNAL OF ANTENNAS AND PROPAGATION
Impact Factor: 0.75
Year: 2015
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Language: English
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Reprint Address: Rmili, H (reprint author), King Abdulaziz Univ, Elect & Comp Engn Dept, POB 80204, Jeddah 21589, Saudi Arabia.
Publisher: HINDAWI PUBLISHING CORPORATION
Web of Science Categories: Engineering, Electrical & Electronic; Telecommunications
Research Areas: Engineering; Telecommunications
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 7914
43. Carbon nanotube-reinforced hydroxyapatite composite and their interaction with human osteoblast in vitro

Khalid, P (Khalid, P.); Hussain, MA (Hussain, M. A.); Rekha, PD (Rekha, P. D.); Arun, AB (Arun, A. B.)

Abstract

As a bone mineral component, hydroxyapatite (HA) has been an attractive bioceramic for the reconstruction of hard tissues. However, its poor mechanical properties, including low fracture toughness and tensile strength, have been a substantial challenge to the application of HA for the replacement of load-bearing and/or large bone defects. In this study, HA is reinforced with high-purity and well-functionalized multiwalled carbon nanotubes (MWCNTs; >99 wt%) having an average diameter of 15 nm and length from 10 to 20 m. The cellular response of these functionalized CNTs and its composites were examined in human osteoblast sarcoma cell lines. Calcium nitrate tetrahydrate (Ca(NO₃)₂·4H₂O) and diammonium hydrogen phosphate ((NH₄)₂HPO₄) were used to synthesize HA in situ. MWCNTs were functionalized by heating at 100 degrees C in 3:1 ratio of sulfuric acid and nitric acid for 60 min with stirring and dispersed in sodium dodecyl benzene sulfonate by sonication. HA particles were produced in MWCNTs solution by adding Ca(NO₃)₂·4H₂O and (NH₄)₂HPO₄ under vigorously stirring conditions. The composite was dried and washed in distilled water followed by heat treatment at 250 degrees C to obtain CNT-HA powder. Physiochemical characterization of the composite material was carried out using Fourier transform infrared spectroscopy, field-emission scanning electron microscopy, energy-dispersive X-ray spectrometer, and X-ray diffractometer. Furthermore, this study investigates the cytotoxic effects of functionalized-MWCNTs (f-MWCNTs) and its composites with HA in human osteoblast sarcoma cell lines. Human osteoblast cells were exposed with different concentrations of f-MWCNTs and its composite with HA. The interactions of f-MWCNT and MWCNT-HA composites were analyzed by 3-(4,5-dimethyl thiazol-2-yl)-2,5-diphenyl tetrazolium bromide assay. The results indicate no detrimental effect on survival or mitochondrial activity of the osteoblast cells. Cell viability decreased with an increase in CNT concentration indicating that MWCNTs and its composite can be cytotoxic at higher dosages. This result provides further evidence that the bionano interface can be developed for CNT-reinforced HA composites for load-bearing bone implants, drug delivery, and tissue engineering.

Sources: HUMAN & EXPERIMENTAL TOXICOLOGY
Impact Factor: 1.604
Year: 2015
Volume: 34
Issue: 5
Pages: 548-556
Cited reference count: 29
Language: English
Document Type: Article
Reprint Address: Arun, AB (reprint author), Yenepoya Univ, Yenepoya Res Ctr, Mangalore 575018, Karnataka, India.
Publisher: SAGE PUBLICATIONS LTD
Web of Science Categories: Toxicology
Research Areas: Toxicology
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 6407
Characterization Methods for the Detection of Multiple Voice Disorders: Neurological, Functional, and Laryngeal Diseases

Orozco-Arroyave, JR (Rafael Orozco-Arroyave, Juan); Belalcazar-Bolanos, EA (Alexander Belalcazar-Bolanos, Elkyn); Arias-Londono, JD (David Arias-Londono, Julian); Vargas-Bonilla, JF (Francisco Vargas-Bonilla, Jesus); Skodda, S (Skodda, Sabine); Rusz, J (R

Abstract

This paper evaluates the accuracy of different characterization methods for the automatic detection of multiple speech disorders. The speech impairments considered include dysphonia in people with Parkinson's disease (PD), dysphonia diagnosed in patients with different laryngeal pathologies (LP), and hypernasality in children with cleft lip and palate (CLP). Four different methods are applied to analyze the voice signals including noise content measures, spectral-cepstral modeling, nonlinear features, and measurements to quantify the stability of the fundamental frequency. These measures are tested in six databases: three with recordings of PD patients, two with patients with LP, and one with children with CLP. The abnormal vibration of the vocal folds observed in PD patients and in people with LP is modeled using the stability measures with accuracies ranging from 81% to 99% depending on the pathology. The spectral-cepstral features are used in this paper to model the voice spectrum with special emphasis around the first two formants. These measures exhibit accuracies ranging from 95% to 99% in the automatic detection of hypernasal voices, which confirms the presence of changes in the speech spectrum due to hypernasality. Noise measures suitably discriminate between dysphonic and healthy voices in both databases with speakers suffering from LP. The results obtained in this study suggest that it is not suitable to use every kind of features to model all of the voice pathologies; conversely, it is necessary to study the physiology of each impairment to choose the most appropriate set of features.

Sources : IEEE JOURNAL OF BIOMEDICAL AND HEALTH INFORMATICS
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Year : 2015
Volume : 19
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Cited reference count : 29
Language : English
Document Type : Article
Reprint Address : Orozco-Arroyave, JR (reprint author), UdeA, Fac Engn, Medellin 1226, Colombia.
Publisher : IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC
Web of Science Categories : Computer Science, Information Systems; Computer Science, Interdisciplinary Applications; Mathematical & Computational Biology; Medical Informatics
Research Areas : Computer Science; Mathematical & Computational Biology; Medical Informatics
Faculty Name : Faculty of Engineering

285
Department Name: Electrical and Computer Engineering
DSR No.: 4713
45. Clustering Granular Data and Their Characterization With Information Granules of Higher Type

Gacek, A (Gacek, Adam); Pedrycz, W (Pedrycz, Witold)

Abstract

The study is devoted to the clustering of granular data and an evaluation of the results of such clustering. A comprehensive and systematic approach is developed, which is composed of three fundamental phases: 1) representation of granular data; 2) clustering carried out in the representation space of information granules; and 3) evaluation of quality of clusters following the reconstruction criterion. The reconstruction criterion formed originally for numeric data and leading to an idea of granular prototypes is revisited. We show here an emergence of granular information of higher type, which are used to implement granular interval prototypes. We discuss a way of forming granular data in the context of representation of time series and present clustering of granular time series.
46. Clustering in augmented space of granular constraints: A study in knowledge-based clustering

Pedrycz, W (Pedrycz, Witold); Gacek, A (Gacek, Adam); Wang, XM (Wang, Xianmin)

Abstract

In this study, a paradigm of fuzzy clustering is augmented by available domain knowledge expressed in the form of relational constraints built with the aid of a collection of fuzzy sets. These constraints are described as a collection of Cartesian products of fuzzy sets or their logic expressions are used to form an augmented data space and transform nonlinearly original data. Depending upon the nature of the constraints, discussed are two categories of resulting representations (clustering spaces), namely homogeneous spaces (in case when the transformations are fully expressed by means of the constraints) and heterogeneous spaces (when the resulting space is composed of some original variables present in the initially available data space and those being transformed and expressed by means of satisfaction levels of the constraints). The role of information granules of order-2 is revealed with regard to results of clustering produced in the transformed space. A generalization of the proposed approach is also discussed in case the clustered data are not numeric but are provided in the form of information granules; in this case a special attention is paid to a way in which a representation (description) of information granules is realized through relational constraints. We elaborate on the formation of the space (induced by constraints) and original data as well as discuss the detailed algorithmic developments.

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47. Colored Traveling Salesman Problem

Li, J (Li, Jun); Zhou, MC (Zhou, MengChu); Sun, QR (Sun, Qirui); Dai, XZ (Dai, Xianzhong); Yu, XL (Yu, Xiaolong)

Abstract

The multiple traveling salesman problem (MTSP) is an important combinatorial optimization problem. It has been widely and successfully applied to the practical cases in which multiple traveling individuals (salesmen) share the common workspace (city set). However, it cannot represent some application problems where multiple traveling individuals not only have their own exclusive tasks but also share a group of tasks with each other. This work proposes a new MTSP called colored traveling salesman problem (CTSP) for handling such cases. Two types of city groups are defined, i.e., each group of exclusive cities of a single color for a salesman to visit and a group of shared cities of multiple colors allowing all salesmen to visit. Evidences show that CTSP is NP-hard and a multidepot MTSP and multiple single traveling salesman problems are its special cases. We present a genetic algorithm (GA) with dual-chromosome coding for CTSP and analyze the corresponding solution space. Then, GA is improved by incorporating greedy, hill-climbing (HC), and simulated annealing (SA) operations to achieve better performance. By experiments, the limitation of the exact solution method is revealed and the performance of the presented GAs is compared. The results suggest that SAGA can achieve the best quality of solutions and HCGA should be the choice making good tradeoff between the solution quality and computing time.

Sources: IEEE TRANSACTIONS ON CYBERNETICS
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Year: 2015
Volume: 45
Issue: 11
Pages: 2390-2401
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Language: English
Document Type: Article
Reprint Address: Li, J (reprint author), Southeast Univ, Minist Educ, Key Lab Measurement & Control CSE Complex Syst En, Nanjing 210096, Jiangsu, Peoples R China.
Publisher: IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC
Web of Science Categories: Computer Science, Artificial Intelligence; Computer Science, Cybernetics
Research Areas: Computer Science
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 4783
Comparative analysis of logic operators: A perspective of statistical testing and granular computing

Hu, XC (Hu, Xingchen); Pedrycz, W (Pedrycz, Witold); Wang, XM (Wang, Xianmin)

Abstract

Fuzzy logic operations realized by triangular norms (t-norms and t-conorms) have been intensively studied in their theoretical setting and used in various applications. These operations are inherently numeric constructs yielding numeric results. We pose a question whether two t-norms produce distinct results. The problem is formally expressed as a certain hypothesis testing where a null hypothesis concerns equality of medians of membership grades produced by the two triangular norms. In the sequel, we extend a discussion on composition operations constructed with the aid of both t-norms and t-conorms (s-t and t-s composition operators). A comprehensive suite of experiments deals with a collection of commonly encountered triangular norms including those endowed with some parameters. The null hypothesis is tested with regard to the pairs of triangular norms as well as the same triangular norm but having two values of its parameter. We introduce a concept of granular t-norms (more specifically, t-norms operating on granular arguments) and discuss an idea of granular equivalence of logic operators. (C) 2015 Elsevier Inc. All rights reserved.
49. Confidence-consistency driven group decision making approach with incomplete reciprocal intuitionistic preference relations

Urena, R (Urena, Raquel); Chiclana, F (Chiclana, Francisco); Fujita, H (Fujita, Hamido); Herrera-Viedma, E (Herrera-Viedma, Enrique)

Abstract

Intuitionistic preference relations constitute a flexible and simple representation format of experts' preference on a set of alternative options, while at the same time allowing to accommodate degrees of hesitation inherent to all decision making processes. In comparison with fuzzy preference relations, the use of intuitionistic fuzzy preference relations in decision making is limited, which is mainly due to the computational complexity associated to using membership degree, non-membership degree and hesitation degree to model experts' subjective preferences. In this paper, the set of reciprocal intuitionistic fuzzy preference relations and the set of asymmetric fuzzy preference relations are proved to be mathematically isomorphic. This result can be exploited to use methodologies developed for fuzzy preference relations to the case of intuitionistic fuzzy preference relations and, ultimately, to overcome the computation complexity mentioned above and to extend the use of reciprocal intuitionistic fuzzy preference relations in decision making. In particular, in this paper, this isomorphic equivalence is used to address the presence of incomplete reciprocal intuitionistic fuzzy preference relations in decision making by developing a consistency driven estimation procedure via the corresponding equivalent incomplete asymmetric fuzzy preference relation procedure. Additionally, the hesitancy degree of the reciprocal intuitionistic fuzzy preference relation is used to introduce the concept of expert's confidence from which a group decision making procedure, based on a new aggregation operator that takes into account not only the experts' consistency but also their confidence degree towards the opinion provided, is proposed. (C) 2015 Elsevier B.V. All rights reserved.
50. Consensus of multi-agent systems in the cooperation-competition network with inherent nonlinear dynamics: A time-delayed control approach

Hu, HX (Hu, Hong-xiang); Yu, WW (Yu, Wenwu); Xuan, Q (Xuan, Qi); Yu, L (Yu, Li); Xie, GM (Xie, Guangming)

Abstract

In this paper, the consensus problem is investigated for a group of first-order agents in the cooperation-competition network, where agents can cooperate or even compete with each other, i.e., the elements in the coupling weight matrix of the graph can be either positive or negative. In order to solve this consensus problem, the whole network is firstly divided into two sub-networks, i.e., the cooperation sub-network and the competition sub-network, and then two kinds of time-delayed control schemes are designed in the competition sub-network. By combining the Lyapunov theory together with the synchronization manifold method, several effective sufficient conditions of consensus are provided without assuming that the interaction topology is strongly connected or contains a directed spanning tree, which means that the competition relationships could help the agents achieve consensus under the time-delayed control designed in the competition sub-network. Moreover, the results are also extended to the pure competition networks where all the elements in the weight matrices are either zeros or negative. Finally, some simulation examples are provided to validate the effectiveness of the theoretical analysis. (C) 2015 Elsevier B.V. All rights reserved.

Sources : NEUROCOMPUTING
ISO Source Abbrev: Neurocomputing
Impact Factor : 2.392
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Volume : 158
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Cited reference count : 29
Language : English
Document Type : Article
Reprint Address : Hu, HX (reprint author), Hangzhou Dianzi Univ, Dept Math, Hangzhou 310018, Zhejiang, Peoples R China.
Publisher : ELSEVIER SCIENCE BV
Web of Science Categories : Computer Science, Artificial Intelligence
Research Areas : Computer Science
Faculty Name : Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No. : 5966
Constrained robust adaptive control for vehicle active suspension systems
Pan, HH (Pan, Huihui); Sun, WC (Sun, Weichao); Gao, HJ (Gao, Huijun); Hayat, T (Hayat, Tasawar); Alsaadi, F (Alsaadi, Fuad)

Abstract
In this paper, a constrained robust adaptive control strategy is presented for active suspension systems in the presence of non-symmetric input saturations, whose objective is to stabilise the attitude of the vehicle and improve ride comfort. In particular, by means of command filtering idea, an auxiliary system is constructed to reduce the negative effects caused by possible saturations, and the following stability proof ensures the theoretical strictness. Furthermore, the proposed constrained robust adaptive control approach is applied to a quarter-car active suspension system, where nonlinear spring and piecewise linear damper are adopted. Finally, a numerical example simulation with typical periodic road input is conducted to verify the effectiveness of the theoretic results obtained.

Sources
International Journal of Vehicle Design
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Year: 2015
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Pages: 5-21
Cited reference count: 29
Language: English
Document Type: Article
Reprint Address: Sun, WC (reprint author), Harbin Inst Technol, State Key Lab Robot & Syst HIT, Harbin 150080, Peoples R China.
Publisher: INDERSCIENCE ENTERPRISES LTD
Web of Science Categories: Engineering, Mechanical; Transportation Science & Technology
Research Areas: Engineering; Transportation
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 7814
Contrastive divergence for memristor-based restricted Boltzmann machine

Sheri, AM (Sheri, Ahmad Muqeem); Rafique, A (Rafique, Aasim); Pedrycz, W (Pedrycz, Witold); Jeon, M (Jeon, Moongu)

Abstract

Restricted Boltzmann machines and deep belief networks have been shown to perform effectively in many applications such as supervised and unsupervised learning, dimensionality reduction and feature learning. Implementing networks, which use contrastive divergence as the learning algorithm on neuromorphic hardware, can be beneficial for real-time hardware interfacing, power efficient hardware and scalability. Neuromorphic hardware which uses memristors as synapses is one of the most promising areas to achieve the above-mentioned goals. This paper presents a restricted Boltzmann machine which uses a two memristor model to emulate synaptic weights and achieves learning using contrastive divergence. (C) 2014 Elsevier Ltd. All rights reserved.

Sources : ENGINEERING APPLICATIONS OF ARTIFICIAL INTELLIGENCE
Impact Factor : 2.368
Year : 2015
Volume : 37
Pages : 336-342
Cited reference count : 29
Language : English
Document Type : Article
Reprint Address : Jeon, M (reprint author), Gwangiu Inst Sci & Technol, Sch Informat & Commun, Kwangju, South Korea.
Publisher : PERGAMON-ELSEVIER SCIENCE LTD
Web of Science Categories : Automation & Control Systems; Computer Science, Artificial Intelligence; Engineering, Multidisciplinary; Engineering, Electrical & Electronic
Research Areas : Automation & Control Systems; Computer Science; Engineering
Faculty Name : Faculty of Engineering
Department Name: : Electrical and Computer Engineering
DSR No. : 8377
Abstract

In wireless communication, the amplitude and phase of the transmitted signal have certain patterns during one symbol duration, which introduces high correlation among the samples obtained by oversampling at the receiver. In this work, we aim to explore such correlation information for cognitive radios to enhance the performance of spectrum sensing. By jointly considering the signal modulation, multipath fading, and oversampling rate, we derive the distribution of the empirical autocorrelation function for the obtained samples, on which we propose two efficient spectrum-sensing algorithms, and then analyze their performance. Our theoretical results reveal that the proposed algorithms with oversampling perform strictly better than the conventional energy detection scheme, while requiring the same level of prior information. Finally, we show through simulations that the derived statistical characteristics approximate the true statistical distribution of the autocorrelation function well, and the proposed sensing algorithms significantly improve the sensing performance compared to several existing sensing schemes.
Coupling Matrix Synthesis of Nonreciprocal Lossless Two-Port Networks Using Gyrators and Inverters

Zhang, QF (Zhang, Qingfeng); Guo, TF (Guo, Tongfeng); Khan, BA (Khan, Bakhtiar Ali); Kodera, T (Kodera, Toshiro); Caloz, C (Caloz, Christophe)

Abstract

A coupling matrix technique is presented for the synthesis of nonreciprocal lossless two-port networks. This technique introduces complex inverters to build the nonreciprocal transversal network corresponding to the nonreciprocal coupling matrix. It subsequently transforms this matrix into canonical topologies through complex similarity transformations. The complex inverters in the final topology are transformed into real inverters and gyrators for implementation simplicity. A second-order network example and a fourth-order network example, as well as an experimental validation, are then provided to illustrate the proposed technique. Finally, other possible implementations of the nonreciprocal gyrators are discussed.

Sources: IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES
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Year: 2015
Volume: 63
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Cited reference count: 29
Language: English
Document Type: Article
Reprint Address: Zhang, QF (reprint author), South Univ Sci & Technol China, Dept Elect & Elect Engn, Shenzhen 518055, Guangdong, Peoples R China.
Publisher: IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC
Web of Science Categories: Engineering, Electrical & Electronic
Research Areas: Engineering
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 5332
Data description: A general framework of information granules

Pedrycz, W (Pedrycz, Witold); Succi, G (Succi, Giancarlo); Sillitti, A (Sillitti, Alberto); Iljazi, J (Iljazi, Joana)

Abstract

The study is concerned with a granular data description in which we propose a characterization of numeric data by a collection of information granules so that the key structure of the data, their topology and essential relationships are described in the form of a family of fuzzy sets - information granules. A comprehensive design process is introduced in which we show a two-phase development strategy: first, numeric prototypes are built with the use of Fuzzy C-Means (FCM) that is followed by their augmentation resulting in a collection of information granules. In the design of information granules we engage the fundamental ideas of Granular Computing, especially the principle of justifiable granularity. A series of experiments is presented to visualize the key steps of the construction of information granules. (C) 2015 Elsevier B.V. All rights reserved.
56. Demand Response Exchange in the Stochastic Day-Ahead Scheduling With Variable Renewable Generation

Wu, HY (Wu, Hongyu); Shahidehpour, M (Shahidehpour, Mohammad); Alabdulwahab, A (Alabdulwahab, Ahmed); Abusorrah, A (Abusorrah, Abdullah)

Abstract

This paper proposes a pool-based demand response exchange (DRX) model in which economic demand response (DR) is traded among DR participants as an alternative for managing the variability of renewable energy sources (RES). Load curtailment bids are provided by individual DRX participants and the DRX is cleared by maximizing the total social welfare, which is subject to supply-demand balance and individual bidders' inter-temporal operation constraints. The proposed DRX model is further integrated in the current context of the ISO's day-ahead scheduling in electricity markets. A two-step sequential market clearing framework is presented in which the ISO's stochastic day-ahead scheduling is simulated first for calculating the expected locational marginal prices (LMPs) and then, the proposed DRX is cleared successively using the expected LMPs. The simulation of the ISO's stochastic day-ahead scheduling incorporates random outages of system components and forecast errors for hourly renewable generation and loads. The decomposition-based method is employed to solve the ISO's day-ahead scheduling in the base case and scenarios. Numerical tests are performed for a 6-bus system and an IEEE 118-bus system. The results demonstrate the benefit of utilizing the DRX model for customer market participation in the ISO's day-ahead market scheduling.

Sources: IEEE TRANSACTIONS ON SUSTAINABLE ENERGY
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Language: English
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Reprint Address: Wu, HY (reprint author), Natl Renewable Energy Lab, Power Syst Engn Ctr, Golden, CO 80401 USA.
Publisher: IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC
Web of Science Categories: GREEN & SUSTAINABLE SCIENCE & TECHNOLOGY; Energy & Fuels; Engineering, Electrical & Electronic
Research Areas: Science & Technology - Other Topics; Energy & Fuels; Engineering
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 6650
57. Description and classification of granular time series

Al-Hmouz, R (Al-Hmouz, Rami); Pedrycz, W (Pedrycz, Witold); Balamash, A (Balamash, Abdullah); Morfeq, A (Morfeq, Ali)

Abstract

The study is concerned with a concept and a design of granular time series and granular classifiers. In contrast to the plethora of various models of time series, which are predominantly numeric, we propose to effectively exploit the idea of information granules in the description and classification of time series. The numeric (optimization-oriented) and interpretation abilities of granular time series and their classifiers are highlighted and quantified. A general topology of the granular classifier involving a formation of a granular feature space and the usage of the framework of relational structures (relational equations) in the realization of the classifiers is presented. A detailed design process is elaborated on along with a discussion of the pertinent optimization mechanisms. A series of experiments is covered leading to a quantitative assessment of the granular classifiers and their parametric analysis.

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Document Type: Article
Reprint Address: Al-Hmouz, R (reprint author), King Abdulaziz Univ, Elect & Comp Engn Dept, Jeddah 21413, Saudi Arabia.
Publisher: SPRINGER
Web of Science Categories: Computer Science, Artificial Intelligence; Computer Science, Interdisciplinary Applications
Research Areas: Computer Science
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 6696
Description and prediction of time series: A general framework of Granular Computing

Al-Hmouz, R (Al-Hmouz, Rami); Pedrycz, W (Pedrycz, Witold); Balamash, A (Balamash, Abdullah)

Abstract

In this paper, we address problems of description and prediction of time series by developing architectures of granular time series. Granular time series are models of time series formed at the level of information granules expressed in the representation space and time. With regard to temporal granularity, time series is split into temporal windows leading in this way to the formation of temporal information granules. Information granules are also quantified and constructed over the space of amplitude and change of amplitude of the series collected over time windows. In the description of time series we involve clustering techniques and build information granules in the representation space (viz, the space of amplitude and change of amplitude) of the temporal data. Fuzzy relations forming the essence of the prediction model are optimized using particle swarm optimization. Experimental results are reported for a number of publicly available time series. (C) 2015 Elsevier Ltd. All rights reserved.
59. **Design of high gain slotted patch antenna with defected ground for WLAN/WiMAX applications**

Ahsan, MR (Ahsan, M. R.); Islam, MT (Islam, M. T.); Ullah, MH (Ullah, M. Habib); Aldhaheri, RW (Aldhaheri, R. W.); Sheikh, MM (Sheikh, M. M.)

**Abstract**

A new defected ground plane planar antenna feed by microstrip line is proposed for triple-band wireless communications. The proposed design of the antenna contains a radiating patch embedded with pair of open square-loop slot and pair of arc slot, and full length ground plane with defect on it. The final optimized design of the antenna is printed on ceramic filled polytetrafluoroethylene based dielectric substrate with size of 50 mm x 55 mm and 1.905 mm thick. The measured data reveal that the antenna offers bandwidths of 630, 600 and 690 MHz at 2.49, 3.54 and 5.6 center resonant frequency respectively which can cover the bandwidth requirements for WLAN/WiMAX standards. The antenna offers good radiation pattern and reflection coefficient characteristics in the frequency band of interest. Moreover, the experimental results well agreed with the simulated results of the proposed antenna and it can be a good candidate for multiband operations in wireless applications.

**Sources**

| ISO Source Abbrev | INTERNATIONAL JOURNAL OF APPLIED ELECTROMAGNETICS AND MECHANICS |
|-------------------|-----------------------------------------------------------------
| Impact Factor     | 0.724                                                            |
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| Publisher         | IOS PRESS                                                        |
| Web of Science Categories | Engineering, Electrical & Electronic; Mechanics; Physics, Applied |
| Research Areas    | Engineering; Mechanics; Physics                                  |
| Faculty Name      | Faculty of Engineering                                           |
| Department Name   | Electrical and Computer Engineering                              |
| DSR No.           | 7641                                                             |

Huang, YS (Huang, Yi-Sheng); Weng, YS (Weng, Yi-Shun); Zhou, MC (Zhou, MengChu)

Abstract

Timed Petri nets (TPNs) are useful for performance evaluation of discrete event systems due to their mathematical formalism. This paper focuses on their use to model the preemption of emergency vehicle systems. The advantage of the proposed approach is the clear presentation of traffic light behaviors in terms of conditions and events that cause the preemption of phases being changed. The resulting models allow one to identify and thus avoid urgent spectacles in such systems by conditions and events of the model that control the phase of traffic light alternations. Moreover, this work proposes a new emergency vehicle preemption policy to ensure that emergency vehicles can pass through intersections with no or less delay. The analysis is performed to demonstrate how the models enforce the phase of traffic transitions by a reachability graph with time information. The liveness and reversibility of the proposed model are verified. To our knowledge, this is the first work that employs TPNs to model an emergency vehicle preemption system and identify its urgent spectacles for the purpose of their complete avoidance. This helps advance the state-of-the-art in traffic safety related to the intersection of roadways.

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Web of Science Categories: Engineering, Civil; Engineering, Electrical & Electronic; Transportation Science & Technology
Research Areas: Engineering; Transportation
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 5594

302
61. Designing granular fuzzy models: A hierarchical approach to fuzzy modeling

Pedrycz, W (Pedrycz, Witold); Al-Hmouz, R (Al-Hmouz, Rami); Balamash, AS (Balamash, Abdullah Saeed); Morfeq, A (Morfeq, Ali)

Abstract

In this study, we elaborate on a distributed fuzzy modeling and ensuing granular fuzzy modeling. Such modeling is realized in the presence of separate and locally available data while the ensuing fuzzy rule-based models constructed on their basis are regarded as individual sources of knowledge. In virtue of an inherent diversity of these sources (models) and in an attempt to quantify it, a global model being formed at the higher level of hierarchy is becoming more abstract than those at the lower level is referred to as a granular fuzzy model. An essential concept of this class of models is introduced and their enhanced functionality is studied. Furthermore, we show interesting linkages of these models with type-2 fuzzy models studied in the literature. We highlight a number of arguments motivating a need and justifiable relevance of higher type of information granules. A detailed discussion on fuzzy rule-based models exhibiting an interesting aspect of an incremental format of the rules (whose rules capture an incremental description of input output relationships formed with respect to some simple reference model (say, constant or linear) is presented. The design practice of the models is elaborated on by highlighting in this context the use of augmented fuzzy clustering. The construction of a granular fuzzy model is guided by the principle of justifiable granularity using which we show how granular parameters of the models are formed. The performance of the model is quantified with respect to the two criteria, namely coverage of experimental data and specificity of granular results. Experimental studies are reported for both synthetic and publicly available data sets. (C) 2014 Elsevier B.V. All rights reserved.
Abstract

In this paper, we consider the distributed containment control problem for multiagent systems with unknown nonlinear dynamics. More specifically, we focus on multiple second-order nonlinear systems and networked Lagrangian systems. We first study the distributed containment control problem for multiple second-order nonlinear systems with multiple dynamic leaders in the presence of unknown nonlinearities and external disturbances under a general directed graph that characterizes the interaction among the leaders and the followers. A distributed adaptive control algorithm with an adaptive gain design based on the approximation capability of neural networks is proposed. We present a necessary and sufficient condition on the directed graph such that the containment error can be reduced as small as desired. As a byproduct, the leaderless consensus problem is solved with asymptotical convergence. Because relative velocity measurements between neighbors are generally more difficult to obtain than relative position measurements, we then propose a distributed containment control algorithm without using neighbors’ velocity information. A two-step Lyapunov-based method is used to study the convergence of the closed-loop system. Next, we apply the ideas to deal with the containment control problem for networked unknown Lagrangian systems under a general directed graph. All the proposed algorithms are distributed and can be implemented using only local measurements in the absence of communication. Finally, simulation examples are provided to show the effectiveness of the proposed control algorithms.
63. Distributed Kalman Filtering Over Massive Data Sets: Analysis Through Large Deviations of Random Riccati Equations

Li, D (Li, Di); Kar, S (Kar, Soummya); Moura, JMF (Moura, Jose M. F.); Poor, HV (Poor, H. Vincent); Cui, SG (Cui, Shuguang)

Abstract

This paper studies the convergence of the estimation error process and the characterization of the corresponding invariant measure in distributed Kalman filtering for potentially unstable and large linear dynamic systems. A gossip network protocol termed modified gossip interactive Kalman filtering (M-GIKF) is proposed, where sensors exchange their filtered states (estimates and error covariances) and propagate their observations via intersensor communications of rate \( \gamma \). \( \gamma \) is defined as the averaged number of intersensor message passages per signal evolution epoch. The filtered states are interpreted as stochastic particles swapped through local interaction. This paper shows that the conditional estimation error covariance sequence at each sensor under M-GIKF evolves as a random Riccati equation (RRE) with Markov modulated switching. By formulating the RRE as a random dynamical system, it is shown that the network achieves weak consensus, i.e., the conditional estimation error covariance at a randomly selected sensor converges weakly (in distribution) to a unique invariant measure. Further, it is proved that as \( \gamma \rightarrow \infty \) this invariant measure satisfies the large deviation (LD) upper and lower bounds, implying that this measure converges exponentially fast (in probability) to the Dirac measure \( \delta_{P^*} \), where \( P^* \) is the stable error covariance of the centralized (Kalman) filtering setup. The LD results answer a fundamental question on how to quantify the rate at which the distributed scheme approaches the centralized performance as the intersensor communication rate increases.
Abstract

This paper studies a Quantized Gossip-based Interactive Kalman Filtering (QGIKF) algorithm implemented in a wireless sensor network, where the sensors exchange their quantized states with neighbors via inter-sensor communications. We show that, in the countable infinite quantization alphabet case, the network can still achieve weak consensus with the information loss due to quantization, i.e., the estimation error variance sequence at a randomly selected sensor can converge weakly (in distribution) to a unique invariant measure. To prove the weak convergence, we first interpret error variance sequences as interacting particles, then model each sequence evolution as a Random Dynamical System (RDS), and further prove its stochastically bounded nature. Moreover, based on the analysis for the countable infinite quantization alphabet case, we also prove that under certain conditions the network can also achieve weak consensus, when the quantization alphabet is finite, which is more restricted and practical.
Distributed proximity-based granular clustering: towards a development of global structural relationships in data

Pedrycz, W (Pedrycz, Witold); Al-Hmouz, R (Al-Hmouz, Rami); Morfeq, A (Morfeq, Ali); Balamash, AS (Balamash, Abdullah Saeed)

Abstract

The study is focused on a development of a global structure in a family of distributed data realized on a basis of locally discovered structures. The local structures are revealed by running fuzzy clustering (Fuzzy C-Means), whereas building a global view is realized by forming global proximity matrices on a basis of the local proximity matrices implied by the partition matrices formed for the individual data sets. To capture the diversity of local structures, a global perspective at the structure of the data is captured in terms of a granular proximity matrix, which is built by invoking a principle of justifiable granularity with regard to the aggregation of individual proximity matrices. The three main scenarios are investigated: (a) designing a global structure among the data through building a granular proximity matrix, (b) refining a local structure (expressed in the form of a partition matrix) by engaging structural knowledge conveyed at the higher level of the hierarchy and provided in the form of the granular proximity matrix, (c) forming a consensus-building scheme and updating all local structures with the aid of the proximity dependences available at the upper layer of the hierarchy. While the first scenario delivers a passive approach to the development of the global structure, the two others are of an active nature by facilitating a structural feedback between the local and global level of the hierarchy of the developed structures. The study is illustrated through a series of experiments carried out for synthetic and publicly available data sets.
Dynamic Heterogeneous Learning Games for Opportunistic Access in LTE-Based Macro/Femtocell Deployments

Alnwaimi, G (Alnwaimi, Ghassan); Vahid, S (Vahid, Seiamak); Moessner, K (Moessner, Klaus)

Abstract

Interference is one of the most limiting factors when trying to achieve high spectral efficiency in the deployment of heterogeneous networks (HNs). In this paper, the HN is modeled as a layer of closed-access LTE femtocells (FCs) overlaid upon an LTE radio access network. Within the context of dynamic learning games, this work proposes a novel heterogeneous multiobjective fully distributed strategy based on a reinforcement learning (RL) model (CODIPAS-HRL) for FC self-configuration/optimization. The self-organization capability enables the FCs to autonomously and opportunistically sense the radio environment using different learning strategies and tune their parameters accordingly, in order to operate under restrictions of avoiding interference to both network tiers and satisfy certain quality-of-service requirements. The proposed model reduces the learning cost associated with each learning strategy. We also study the convergence behavior under different learning rates and derive a new accuracy metric in order to provide comparisons between the different learning strategies. The simulation results show the convergence of the learning model to a solution concept based on satisfaction equilibrium, under the uncertainty of the HN environment. We show that intra/inter-tier interference can be significantly reduced, thus resulting in higher cell throughputs.
67. Economic analysis of PV/diesel hybrid system with flywheel energy storage

Ramli, MAM (Ramli, Makbul A. M.); Hiendro, A (Hiendro, Ayong); Twaha, S (Twaha, Ssennoga)

Abstract

This paper analyzes a hybrid energy system performance with photovoltaic (PV) and diesel systems as the energy sources. The hybrid energy system is equipped with flywheel to store excess energy from the PV. HOMER software was employed to study the economic and environmental benefits of the system with flywheels energy storage for Makkah, Saudi Arabia. The analysis focused on the impact of utilizing flywheel on power generation, energy cost, and net present cost for certain configurations of hybrid system. Analyses on fuel consumption and carbon emission reductions for the system configurations were also presented in this paper. (C) 2015 Elsevier Ltd. All rights reserved.
Efficient Numerical Modelling of a Special Class of Photonic Crystals using the Tight Binding Approach

Chamanara, N (Chamanara, Nima); Caloz, C (Caloz, Christophe)

Abstract

The tight binding approach is adopted for efficient numerical analysis of a certain class of photonic crystals that have similarities to their semiconductor counterparts. A systematic approach is proposed to replicate the band structure of a solid-state material in a photonic crystal.
Efficient removal of phenol and aniline from aqueous solutions using graphene oxide/polypyrrole composites

Hu, R (Hu, Rui); Dai, SY (Dai, Songyuan); Shao, DD (Shao, Dadong); Alsaedi, A (Alsaedi, Ahmed); Ahmad, B (Ahmad, Bashir); Wang, XK (Wang, Xiangke)

Abstract

A novel approach was developed to fabricate graphene oxide/polypyrrole (GO/PPy) composites via dielectric barrier discharge (DBD) plasma technique in nitrogen and room temperature conditions, and characterized by scanning electron microscopy (SEM), X-ray diffraction (XRD), Fourier transformed infrared spectroscopy (FT-IR), thermal gravimetric analysis (TGA), and X-ray photoelectron spectroscopy (XPS) in details. The sorption of phenol and aniline on the GO/PPy composites from aqueous solutions was investigated as a function of contact time, solid content, pH and initial concentrations of sorbates. The sorption capacities of phenol and aniline on the GO/PPy composites were much higher than those of phenol and aniline on many of today’s materials. The sorption of phenol and aniline on GO/PPy composites obeyed the Langmuir model, and was mainly attributed to ion exchange, pi-pi electron donor-acceptor (EDA) interaction, hydrophobic interaction and Lewis acid-base interaction. The thermodynamic parameters calculated from the temperature-dependent sorption isotherms suggested that phenol and aniline sorption on GO/PPy composites was an endothermic and spontaneous process. Moreover, GO/PPy composites could be regenerated through the phenol and aniline desorption by ethanol, and cycling reused without obvious decrease of sorption capacity. All these results indicated that the GO/PPy composites were suitable materials for the preconcentration of phenol and aniline from aqueous solutions in environmental pollution management. (C) 2014 Elsevier B.V. All rights reserved.
Elastomeric nanocomposite scaffolds made from poly(glycerol sebacate) chemically crosslinked with carbon nanotubes

Gaharwar, AK (Gaharwar, Akhilesh K.); Patel, A (Patel, Alpesh); Dolatshahi-Pirouz, A (Dolatshahi-Pirouz, Alireza); Zhang, HB (Zhang, Hongbin); Rangarajan, K (Rangarajan, Kaushik); Iviglia, G (Iviglia, Giorgio); Shin, SR (Shin, Su-Ryon); Hussain, MA (Hussa

Abstract

Carbon nanotube (CNT)-based nanocomposites often possess properties such as high stiffness, electrical conductivity, and thermal stability and have been studied for various biomedical and biotechnological applications. However, the current design approaches utilize CNTs as physical fillers, and thus, the true potential of CNT-based nanocomposites has not been realized. Here, we introduce a general approach to fabricating stiff, elastomeric nanocomposites from poly(glycerol sebacate) (PGS) and CNTs. The covalent crosslinking between the nanotubes and polymer chains resulted in novel property combinations that are not observed in conventional nanocomposites. The addition of 1% CNTs resulted in a five-fold increase in the tensile modulus and a six-fold increase in compression modulus compared with PGS alone, which is far superior to the previously reported studies for CNT-based nanocomposites. Despite a significant increase in mechanical stiffness, the elasticity of the network was not compromised and the resulting nanocomposites showed more than 94% recovery. This study demonstrates that the chemical conjugation of CNTs to a PGS backbone results in stiff and elastomeric nanocomposites. Additionally, in vitro studies using human mesenchymal stem cells (hMSCs) indicated that the incorporation of CNTs into the PGS network significantly enhanced the differentiation potential of the seeded hMSCs, rendering them potentially suitable for applications ranging from scaffolding in musculoskeletal tissue engineering to biosensors in biomedical devices.

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Web of Science Categories : Materials Science, Biomaterials
Research Areas : Materials Science
Faculty Name : Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No. : 8405
71. Electrical and photoresponse properties of Au/reduced graphene:poly(3-hexylthiophene) nanocomposite/p-Si photodiodes

Wageh, S (Wageh, S.); Al-Ghamdi, AA (Al-Ghamdi, Ahmed A.); Al-Turki, Y (Al-Turki, Yusuf); Dere, A (Dere, Aysegul); Tjong, SC (Tjong, S. C.); El-Tantawy, F (El-Tantawy, Farid); Yakuphanoglu, F (Yakuphanoglu, F.)

Abstract

Au/reduced graphene:poly(3-hexylthiophene) (P3HT) nanocomposite/p-Si/Al diodes have been prepared and their electrical characteristics have been investigated using current-voltage, capacitance-voltage and conductance-voltage measurements. The electronic parameters such as ideality factor (n) and barrier height (φ) were determined. The photocurrent of the diodes is higher than their dark current. This indicates that the diodes exhibited a photoconducting behavior under various illumination conditions. The diode having molar ratio of RG:P3HT 0.005 gives the highest photoresponsivity. This diode was analyzed in detail. The prepared Au/ RG:P3HT nanocomposite/p-Si/Al diode can be used as a solar position sensor for two axes tracking systems, a light meter, a sunlight detector and automatic shutter control sensor.

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Reprint Address : Al-Ghamdi, AA (reprint author), King Abdulaziz Univ, Fac Sci, Dept Phys, Jeddah 21589, Saudi Arabia.
Publisher : SPRINGER
Web of Science Categories : Engineering, Electrical & Electronic; Optics
Research Areas : Engineering; Optics
Faculty Name : Faculty of Engineering
Department Name : Electrical and Computer Engineering
DSR No. : 5840
Employing dual scaling mode for adaptive hill climbing method on buck converter

Tan, CY (Tan, Chin Yew); Abd Rahim, N (Abd Rahim, Nasrudin); Selvaraj, J (Selvaraj, Jeyraj)

Abstract

For adaptive hill climbing method, variable stepping is achieved by sizing the change of power over the change of voltage \( \frac{dP}{dV} \) and change of power over change of duty cycle \( \frac{dP}{dD} \) to appropriate step size using a properly tuned scaling factor. However, the photovoltaic (PV) power versus voltage curve has two different slopes which are the left-hand side of the maximum power point (MPP), and right-hand side of MPP (ROM). The fine-tuned scaling factor for the left-hand side PV slope has good performance at left-hand side of MPP (LOM) but can cause overshoot when system operates at the ROM; while scaling factor properly tuned for the right-hand side PV slope has good performance at ROM but slow voltage response when the system operates at LOM. Dual scaling factor technique is proposed to achieve good performance at LOM and ROM. Besides that, the drawback of implementing hill climbing method on buck converter is discussed, where using constant step size, the hill climbing method has small voltage response at point far from MPP but large voltage response at point near MPP. Based on the results obtained from a lab-scale prototype, it is proven that the proposed method is simple and effective.

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Reprint Address: Tan, CY (reprint author), Univ Malaya, Dept Elect Engn, Fac Engn, Kuala Lumpur, Malaysia.
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Web of Science Categories: GREEN & SUSTAINABLE SCIENCE & TECHNOLOGY; Energy & Fuels; Engineering, Electrical & Electronic
Research Areas: Science & Technology - Other Topics; Energy & Fuels; Engineering
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 4732
73. Entropic One-Class Classifiers

Livi, L (Livi, Lorenzo); Sadeghian, A (Sadeghian, Alireza); Pedrycz, W (Pedrycz, Witold)

Abstract

The one-class classification problem is a well-known research endeavor in pattern recognition. The problem is also known under different names, such as outlier and novelty/anomaly detection. The core of the problem consists in modeling and recognizing patterns belonging only to a so-called target class. All other patterns are termed nontarget, and therefore, they should be recognized as such. In this paper, we propose a novel one-class classification system that is based on an interplay of different techniques. Primarily, we follow a dissimilarity representation-based approach; we embed the input data into the dissimilarity space (DS) by means of an appropriate parametric dissimilarity measure. This step allows us to process virtually any type of data. The dissimilarity vectors are then represented by weighted Euclidean graphs, which we use to determine the entropy of the data distribution in the DS and at the same time to derive effective decision regions that are modeled as clusters of vertices. Since the dissimilarity measure for the input data is parametric, we optimize its parameters by means of a global optimization scheme, which considers both mesoscopic and structural characteristics of the data represented through the graphs. The proposed one-class classifier is designed to provide both hard (Boolean) and soft decisions about the recognition of test patterns, allowing an accurate description of the classification process. We evaluate the performance of the system on different benchmarking data sets, containing either feature-based or structured patterns. Experimental results demonstrate the effectiveness of the proposed technique.
Abstract

A unified approach to the analysis of synchronization for complex dynamical networks, i.e., networks of partial-state coupled linear systems and networks of full-state coupled nonlinear oscillators, is introduced. It is shown that the developed analysis can be used to describe the difference between the state of each node and the weighted sum of the states of those nodes playing the role of leaders in the networks, thus making it feasible to consider the error dynamics for the whole network system. Different from the other various methods given in the existing literature, the analysis employed in this paper is demonstrated successfully in not only providing the consistent convergence analysis with much simpler form, but also explicitly specifying the convergence rate.
75. Family of state space least mean power of two-based algorithms

Moinuddin, M (Moinuddin, Muhammad); Al-Saggaf, UM (Al-Saggaf, Ubaid M.); Ahmed, A (Ahmed, Arif)

Abstract

In this work, a novel family of state space adaptive algorithms is introduced. The proposed family of algorithms is derived based on stochastic gradient approach with a generalized least mean cost function $J[k] = E[\parallel \epsilon[k] \parallel^{2L}]$ for any integer $L$. Since this generalized cost function is having power $2L$, it includes the whole family of the power of two-based algorithms by having different values of $L$. The novelty of the work resides in the fact that such a cost function has never been used in the framework of state space model. It is a well-known fact that the knowledge of state space model improves the estimation of state parameters of that system. Hence, by employing the state space model with a generalized cost function, we provide an efficient way to estimate the state parameters. The proposed family of algorithms inherit simplicity in its structure due to the use of stochastic gradient approach in contrast to the other model-based algorithms such as Kalman filter and its variants. This fact is supported by providing a comparison of the computational complexities of these algorithms. More specifically, the proposed family of algorithms has computational complexity far lesser than that of the Kalman filter. The stability of the proposed family of algorithms is analysed by providing the convergence analysis. Extensive simulations are presented to provide concrete justification and to compare the performances of the proposed family of algorithms with that of the Kalman filter.
76. **Field effect tuning of microwave Faraday rotation and isolation with large-area graphene**

Skulason, HS (Skulason, Helgi S.); Sounas, DL (Sounas, Dimitrios L.); Mahvash, F (Mahvash, Farzaneh); Francoeur, S (Francoeur, Sebastien); Siaj, M (Siaj, Mohamed); Caloz, C (Caloz, Christophe); Szkopek, T (Szkopek, Thomas)

**Abstract**

We have demonstrated field effect tuning of microwave frequency Faraday rotation in magnetically biased large-area graphene in a hollow circular waveguide isolator geometry. Oxidized intrinsic silicon was used as a microwave transparent back-gate for large-area graphene devices. A 26 dB modulation of isolation in the K-band was achieved with a gate voltage modulation of 10V corresponding to a carrier density modulation of $7 \times 10^{11}/\text{cm}^2$. We have developed a simple analytical model for transmission and isolation of the structure. Field effect modulation of Faraday rotation can be extended to other two dimensional electronic systems and is anticipated to be useful for gate voltage controlled isolators, circulators, and other non-reciprocal devices. (C) 2015 AIP Publishing LLC.

**Sources**

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Publisher: AMER INST PHYSICS
Web of Science Categories: Physics, Applied
Research Areas: Physics
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 5460
FORA - A fuzzy set based framework for online reputation management

Portmann, E (Portmann, Edy); Meier, A (Meier, Andreas); Cudre-Mauroux, P (Cudre-Mauroux, Philippe); Pedrycz, W (Pedrycz, Witold)

Abstract

The Social Web offers increasingly simple ways to publish and disseminate personal or opinionated information, which can rapidly exhibit a disastrous influence on the online reputation of organizations. Based on social Web data, this study describes the building of an ontology based on fuzzy sets. At the end of a recurring harvesting of folksonomies by Web agents, the aggregated tags are purified, linked, and transformed to a so-called fuzzy grassroots ontology by means of a fuzzy clustering algorithm. This self-updating ontology is used for online reputation analysis, a crucial task of reputation management, with the goal to follow the online conversation going on around an organization to discover and monitor its reputation. In addition, an application of the Fuzzy Online Reputation Analysis (FORA) framework, lessons learned, and potential extensions are discussed in this article. (C) 2014 Elsevier B.V. All rights reserved.

Sources

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Web of Science Categories: Computer Science, Theory & Methods; Mathematics, Applied; Statistics & Probability
Research Areas: Computer Science; Mathematics
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 5996
78. From fuzzy data analysis and fuzzy regression to granular fuzzy data analysis

Pedrycz, W (Pedrycz, Witold)

Abstract

This note offers some personal views on the two pioneers of fuzzy sets, late Professors Hideo Tanaka and Kiyoshi Asai. The intent is to share some personal memories about these remarkable researchers and humans, highlight their long-lasting research accomplishments and stress a visible impact on the fuzzy set community. The note elaborates on new and promising research avenues initiated by fuzzy regression and identifies future developments of these models emerging within the realm of Granular Computing and giving rise to a plethora of granular fuzzy models and higher-order and higher-type granular constructs. (C) 2014 Published by Elsevier B.V.

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Research Areas: Computer Science; Mathematics
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 5451
79. **Fuzzy clustering of time series data using dynamic time warping distance**

Izakian, H (Izakian, Hesam); Pedrycz, W (Pedrycz, Witold); Jamal, I (Jamal, Iqbal)

**Abstract**

Clustering is a powerful vehicle to reveal and visualize structure of data. When dealing with time series, selecting a suitable measure to evaluate the similarities/dissimilarities within the data becomes necessary and subsequently it exhibits a significant impact on the results of clustering. This selection should be based upon the nature of time series and the application itself. When grouping time series based on their shape information is of interest (shape-based clustering), using a Dynamic Time Warping (DTW) distance is a desirable choice. Using stretching or compressing segments of temporal data, DTW determines an optimal match between any two time series. In this way, time series exhibiting similar patterns occurring at different time periods, are considered as being similar. Although DTW is a suitable choice for comparing data with respect to their shape information, calculating the average of a collection of time series (which is required in clustering methods) based on this distance becomes a challenging problem. As the result, employing clustering techniques like K-Means and Fuzzy C-Means (where the cluster centers - prototypes are calculated through averaging the data) along with the DTW distance is a challenging task and may produce unsatisfactory results. In this study, three alternatives for fuzzy clustering of time series using DTW distance are proposed. In the first method, a DTW-based averaging technique proposed in the literature, has been applied to the Fuzzy C-Means clustering. The second method considers a Fuzzy C-Medoids clustering, while the third alternative comes as a hybrid technique, which exploits the advantages of both the Fuzzy C-Means and Fuzzy C-Medoids when clustering time series. Experimental studies are reported over a set of time series coming from the UCR time series database. (C) 2015 Elsevier Ltd. All rights reserved.
Fuzzy clustering with semantic interpretation

Liu, XD (Liu, Xiaodong); Wang, XC (Wang, Xianchang); Pedrycz, W (Pedrycz, Witold)

Abstract

In the framework of Axiomatic Fuzzy Set (AFS) theory, we propose a new approach to data clustering. The objective of this clustering is to adhere to some principles of grouping exercised by humans when determining a structure in data. Compared with other clustering approaches, the proposed approach offers more detailed insight into the cluster's structure and the underlying decision making process. This contributes to the enhanced interpretablility of the results via the representation capabilities of AFS theory. The effectiveness of the proposed approach is demonstrated by using real-world data, and the obtained results show that the performance of the clustering is comparable with other fuzzy rule-based clustering methods, and benchmark fuzzy clustering methods FCM and K-means. Experimental studies have shown that the proposed fuzzy clustering method can discover the clusters in the data and help specify them in terms of some comprehensive fuzzy rules. (C) 2014 Elsevier B.V. All rights reserved.
81. Fuzzy decision making and consensus: Challenges

Cabreroz, FJ (Javier Cabreroz, Francisco); Chiclana, F (Chiclana, Francisco); Al-Hmouz, R (Al-Hmouz, Rami); Morfeq, A (Morfeq, Ali); Balamash, AS (Balamash, Abdullah Saeed); Herrera-Viedma, E (Herrera-Viedma, Enrique)

Abstract

Group decision making is part of every organizational life. It is a type of participatory process in which multiple decision makers acting collectively, analyze problems, consider and evaluate several alternatives, and select from among the alternatives a solution. In such a situation, an important issue is the level of agreement or consensus achieved among the group of decision makers before obtaining the solution. In the beginning, consensus was meant as a full and unanimous agreement. Regrettably, this stringent concept of consensus in many cases is a utopia. As a result, and from a pragmatic point of view, it makes more sense to speak about a degree of consensus and, here, the theory of fuzzy sets has delivered new tools for the analysis of such imprecise phenomena like consensus. Given the significance of reaching an accepted solution by all the decision makers, consensus is a major aim of group decision making problems and, in such a way, it has obtained a great attention in the literature. However, there still exist several dares which have to be tackled by the researchers. The purpose of this paper is to bring out several issues that represent challenges that have to be faced.
Abstract

This paper presents a new architecture of a fuzzy decision tree based on fuzzy rules - fuzzy rule based decision tree (FRDT) and provides a learning algorithm. In contrast with "traditional" axis-parallel decision trees in which only a single feature (variable) is taken into account at each node, the node of the proposed decision trees involves a fuzzy rule which involves multiple features. Fuzzy rules are employed to produce leaves of high purity. Using multiple features for a node helps us minimize the size of the trees. The growth of the FRDT is realized by expanding an additional node composed of a mixture of data coming from different classes, which is the only non-leaf node of each layer. This gives rise to a new geometric structure endowed with linguistic terms which are quite different from the "traditional" oblique decision trees endowed with hyperplanes as decision functions. A series of numeric studies are reported using data coming from UCI machine learning data sets. The comparison is carried out with regard to "traditional" decision trees such as C4.5, LADtree, BFTree, SimpleCart, and NBTree. The results of statistical tests have shown that the proposed FRDT exhibits the best performance in terms of both accuracy and the size of the produced trees. (C) 2014 Elsevier Ltd. All rights reserved.
Abstract

Generalized coupled-line all-pass phasers, based on cascaded C-sections (CCSs), cascaded coupled-lines (CCLs), and hybrid-cascaded (HC) coupled transmission-line sections, are presented and demonstrated using analytical, full-wave, and experimental results. It is shown that for N commensurate coupled-line sections, CCL and HC phasers exhibit N group-delay peaks per coupled-line section harmonic frequency band, in contrast to the CCS configuration, which exhibits only one peak within this band. It is also shown that for a given maximum achievable coupling-coefficient, the HC configuration provides the largest group-delay swing. A wave-interference analysis is finally applied to the various coupled-line phasers, explaining their unique group-delay characteristics based on physical wave-propagation mechanisms.
Global Nonlinear Kernel Prediction for Large Data Set With a Particle Swarm-Optimized Interval Support Vector Regression

Ding, YS (Ding, Yongsheng); Cheng, LJ (Cheng, Lijun); Pedrycz, W (Pedrycz, Witold); Hao, KR (Hao, Kuangrong)

Abstract

A new global nonlinear predictor with a particle swarm-optimized interval support vector regression (PSO-ISVR) is proposed to address three issues (viz., kernel selection, model optimization, kernel method speed) encountered when applying SVR in the presence of large data sets. The novel prediction model can reduce the SVR computing overhead by dividing input space and adaptively selecting the optimized kernel functions to obtain optimal SVR parameter by PSO. To quantify the quality of the predictor, its generalization performance and execution speed are investigated based on statistical learning theory. In addition, experiments using synthetic data as well as the stock volume weighted average price are reported to demonstrate the effectiveness of the developed models. The experimental results show that the proposed PSO-ISVR predictor can improve the computational efficiency and the overall prediction accuracy compared with the results produced by the SVR and other regression methods. The proposed PSO-ISVR provides an important tool for nonlinear regression analysis of big data.
Granular fuzzy modeling with evolving hyperboxes in multi-dimensional space of numerical data

Reyes-Galaviz, OF (Reyes-Galaviz, Orion F.); Pedrycz, W (Pedrycz, Witold)

Abstract

Clustering has been applied to numerous areas, including signal and image processing. Many approaches have been developed over the years to efficiently construct granular models on a basis of numerical experimental data. In this study, we propose a novel approach to construct a granular model that is fundamentally designed around information granules regarded as hyperboxes. Several studies have been focused on building a set of hyperboxes around data; one of them being a Min-Max Neural Network (NN) algorithm. Here we develop two different methods to construct these information granules, nevertheless some essential similarities to previous studies can be found. In particular, hyperboxes are constructed by using some reference data, and they are endowed with some parametric flexibility to facilitate controlling their size, whereas the construction of the hyperboxes involve elimination or reduction of possible overlaps between them. In the proposed approach, given a set of input and output data pairs, we construct interval-based information granules to partition the output space (viz, the space of the output variable). On a basis of these intervals, we carry out a so-called context-based Fuzzy C-Means algorithm to construct cluster centers (prototypes) in the multivariable input space. These prototypes serve as hyperbox cores. To construct the information granules, two methods are studied: one develops a family of hyperboxes by realizing some constrictions, while the other one engages Differential Evolution (DE) to realize further optimization. To reduce overlap, two methods are tested: one being previously proposed for the min-max NN and a new one, which engages DE to optimize the overlap reduction. Experimental studies involve synthetic data and publicly available real-world data. The results are compared with the outcomes produced by the algorithm proposed by Simpson. The performance of the method is quantified and it is demonstrated that the obtained results are substantially better when dealing with multi-dimensional data. (C) 2015 Elsevier B.V. All rights reserved.
Abstract

The study is concerned with a design of granular fuzzy models. We exploit a concept of information granularity by developing a model coming as a network of intuitively structured collection of interval information granules described in the output space and a family of induced information granules (in the form of fuzzy sets) formed in the input space. In contrast to most fuzzy models encountered in the literature, the results produced by granular models are information granules rather than plain numeric entities. The design of the model concentrates on a construction of information granules that form a backbone of the overall construct. Interval information granules positioned in the output space are built by considering intervals of equal length, equal probability, and developing an optimized version of the intervals. The induced fuzzy information granules localized in the input space are realized by running a conditional Fuzzy C-Means (FCM). The performance of the model is assessed by considering criteria of coverage and information specificity (information granularity). Further optimization of the model is proposed along the line of an optimal re-distribution of input information granules induced by the individual interval information granules located in the output space. Experimental results involve some synthetic low-dimensional data and publicly available benchmark data sets. (C) 2015 Elsevier Inc. All rights reserved.
87. Granular fuzzy rule-based architectures: Pursuing analysis and design in the framework of granular computing

Pedrycz, W (Pedrycz, Witold)

Abstract

In this study, we propose a new concept of granular rule-based models whose rules assume a format "if G(A(i)) then G(f(i))" where G(.)s are granular generalizations of the numeric conditions and conclusions of the rules. Those generalizations can be expressed e.g., in terms of interval-valued, type-2 or probabilistic fuzzy sets. We discuss several classes of fuzzy models depending upon available information granules and offer a motivation present behind their emergence. The design of these granular architectures exploits the essentials of Granular Computing such as a principle of justifiable granularity and an optimal allocation of information granularity. Detailed investigations of the performance indexes (objective functions) along with the related optimization schemes are covered as well.
Hierarchical power management of a system with autonomously power-managed components using reinforcement learning

Triki, M (Triki, M.); Wang, Y (Wang, Y.); Ammari, AC (Ammari, A. C.); Pedram, M (Pedram, M.)

Abstract

This paper presents a hierarchical dynamic power management (DPM) framework based on reinforcement learning (RL) technique, which aims at power savings in a computer system with multiple I/O devices running a number of heterogeneous applications. The proposed framework interacts with the CPU scheduler to perform effective application-level scheduling, thereby enabling further power savings. Moreover, it considers non-stationary workloads and differentiates between the service request generation rates of various software applications. The online adaptive DPM technique consists of two layers: component-level local power manager and system-level global power manager. The component-level PM policy is pre-specified and fixed whereas the system-level PM employs temporal difference learning on semi-Markov decision process as the model-free RL technique, and it is specifically optimized for a heterogeneous application pool. Experiments show that the proposed approach considerably enhances power savings while maintaining good performance levels. In comparison with other reference systems, the proposed RL-based DPM approach, further enhances power savings, performs well under various workloads, can simultaneously consider power and performance, and achieves wide and deep power-performance tradeoff curves. Experiments conducted with multiple service providers confirm that up to 63% maximum energy saving per service provider can be achieved. (C) 2014 Elsevier B.V. All rights reserved.
89. **Highly efficient non-degenerate four-wave mixing under dual-mode injection in InP/InAs quantum-dash and quantum-dot lasers at 1.55 μm**

Sadeev, T (Sadeev, T.); Huang, H (Huang, H.); Arsenijevic, D (Arsenijevic, D.); Schires, K (Schires, K.); Grillot, F (Grillot, F.); Bimberg, D (Bimberg, D.)

**Abstract**

This work reports on non-degenerate four-wave mixing under dual-mode injection in metalorganic vapor phase epitaxy grown InP/InAs quantum-dash and quantum dot Fabry-Perot laser operating at 1550 nm. High values of normalized conversion efficiency of -18.6 dB, optical signal-to-noise ratio of 37 dB, and third order optical susceptibility normalized to material gain χ(3)/g(0) of similar to 4 x 10^-19 m^3/V are measured for 1490 μm long quantum-dash lasers. These values are similar to those obtained with distributed-feedback lasers and semiconductor optical amplifiers, which are much more complicated to fabricate. On the other hand, due to the faster gain saturation and enhanced modulation of carrier populations, quantum-dot lasers demonstrate 12 dB lower conversion efficiency and 4 times lower χ(3)/g(0) compared to quantum dash lasers. (C) 2015 AIP Publishing LLC.
90. **H-infinity control for 2-D time-delay systems with randomly occurring nonlinearities under sensor saturation and missing measurements**

Liang, JL (Liang, Jinling); Wang, ZD (Wang, Zidong); Liu, XH (Liu, Xiaohui)

**Abstract**

In this paper, the H-infinity output-feedback control problem is investigated for a class of two-dimensional (2-D) nonlinear systems with time-varying delays under imperfect measurements. Randomly occurring nonlinearities (RONs) are introduced in the system to account for probabilistic nonlinear disturbances typically caused by networked environments and governed by a sequence of random variables obeying the Bernoulli distribution. The imperfect measurement outputs are subject to both data missing and randomly occurring sensor saturations (ROSSs), which are put forward to characterize the network-induced phenomena such as probabilistic communication failures and limited capacity of the communication devices. The aim of this paper is to design an output-feedback controller such that the closed-loop system is globally asymptotically stable in the mean square and the prescribed H-infinity performance index is satisfied. Sufficient conditions are presented by resorting to intensive stochastic analysis and matrix inequality techniques, which not only guarantee the existence of the desired controllers for all possible time-delays, RONs, missing measurements and ROSSs but also lead to the explicit expressions of such controllers. Finally, a numerical simulation example is given to demonstrate the applicability of the proposed control scheme. (C) 2014 The Franklin Institute. Published by Elsevier Ltd. All rights reserved.
91. Homogeneous-heterogeneous reaction effects in peristalsis through curved geometry

Hayat, T (Hayat, Tasawar); Tanveer, A (Tanveer, Anum); Alsaadi, F (Alsaadi, Fuad); Alotaibi, ND (Alotaibi, Naif D.)

Abstract

This paper looks at the influence of homogeneous-heterogeneous reactions on the peristaltic transport of non-Newtonian fluid in a curved channel with wall properties. Constitutive relations for thermodynamic third grade material are utilized in the problem development. An electrically conducting fluid in the presence of radial applied magnetic field is considered. The governing flow equations are developed in the presence of viscous heating. Mathematical computations are simplified employing long wavelength and low Reynolds number considerations. The solutions for velocity, temperature, concentration and heat transfer coefficient are obtained and examined. The features of sundry parameters are analyzed by plotting graphs. (C) 2015 Author(s).
92. Human Experts' and a Fuzzy Model's Predictions of Outcomes of Scoliosis Treatment: A Comparative Analysis

Chalmers, E (Chalmers, Eric); Pedrycz, W (Pedrycz, Witold); Lou, E (Lou, Edmond)

Abstract

Brace treatment is the most commonly used nonsurgical treatment for adolescents with idiopathic scoliosis. However, brace treatment is not always successful and the factors influencing its success are not completely clear. This makes treatment outcome difficult to predict. A computer model which can accurately predict treatment outcomes could potentially provide valuable treatment recommendations. This paper describes a fuzzy system that includes a prediction model and a decision support engine. The model was constructed using conditional fuzzy c-means clustering to discover patterns in retrospective patient data. The model's ability to predict treatment outcome was compared to the ability of eight Scoliosis experts. The model and experts each predicted treatment outcome retrospectively for 28 braced patients, and these predictions were compared to the actual outcomes. The model outperformed all but one expert individually and performed similarly to the experts as a group. These results suggest that the fuzzy model is capable of providing meaningful treatment recommendations. This study offers the first model for this application whose performance has been shown to be at or above the human expert level.

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93. Hydromagnetic peristaltic transport of water-based nanofluids with slip effects through an asymmetric channel

Abbasi, FM (Abbasi, F. M.); Hayat, T (Hayat, T.); Alsaadi, F (Alsaadi, F.)

Abstract

This paper addresses the effects of applied magnetic field and partial slip effects in peristalsis of water-based nanofluids in an asymmetric flow configuration. Analysis is carried out using silver and copper nanoparticles. Viscous dissipation, mixed convection, Ohmic heating and heat generation/absorption are considered. Mathematical modeling is done employing lubrication approximations. Resulting coupled system is solved numerically. Physical quantities like axial velocity, pressure gradient, temperature and heat transfer rate are graphically analyzed. Comparison between the silver-water and copper-water nanofluids is presented and analyzed. Results show that the maximum velocity, temperature and heat transfer rate at the wall in silver-water nanofluid are comparatively greater than that of copper-water nanofluid. It is also observed that addition of nanoparticles results in a decrease in the velocity and temperature of fluid. However, the heat transfer rate at the wall is enhanced through addition of nanoparticles.

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Impact of a large negative gain-to-cavity wavelength detuning on the performance of InGaAlAs oxide-confined vertical-cavity surface-emitting lasers

Blokhin, SA (Blokhin, Sergey A.); Bobrov, MA (Bobrov, Mikhail A.); Maleev, NA (Maleev, Nikolai A.); Kuzmenkov, AG (Kuzmenkov, Alexander G.); Sakharov, AV (Sakharov, Alexey V.); Blokhin, AA (Blokhin, Alexey A.); Moser, P (Moser, Philip); Lott, JA (Lott, Ja

Abstract

Vertical-cavity surface-emitting lasers (VCSELs) based on the InGaAlAs-materials system on GaAs substrates are the key component for short-reach data and computer communications systems. Several different modulation schemes have been developed to realize high data bit rates based on various oxide-confined near-infrared VCSEL designs operated under direct current modulation. However, one open question to resolve is the optimal gain-to-cavity wavelength detuning to employ for temperature-stable high-speed performance. We investigate the static and dynamic characteristics of 850 nm high-speed oxide-confined VCSELs with different negative gain-to-cavity wavelength detunings. Our oxide-confined 850 nm VCSELs with a more common similar to 10 nm negative gain-to-cavity detuning demonstrate the conventional optical mode behavior with a classical single-resonance frequency response. With a larger (>= 20 nm) negative detuning, our devices with large oxide-aperture size (> 6 μm) show an anomalous start of lasing via higher order modes with a subsequent switching to lasing via the lowest order modes at higher currents. At intermediate currents, co-lasing via two types of transverse modes and a two-resonance modulation response is observed. The increase of operation temperature as well as the reduction in the oxide-aperture area resulted in classical lasing of index-guided VCSELs. The observed optical mode behavior can be attributed to the specific index guiding profile caused by the oxide-apertures, low internal optical losses, and the large gain-to-cavity detuning. Moreover, one can suggest that the complex shape of the modulation response results from the mode competition for the available gain during an interesting co-lasing operating regime.

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Impact of environmental conditions on the sorption behavior of radionuclide Sr-90(II) on Na-montmorillonite

Yu, SJ (Yu, Shujun); Mei, HY (Mei, Huiyang); Chen, X (Chen, Xin); Tan, XL (Tan, Xiaoli); Ahmad, B (Ahmad, Bashir); Alsaedi, A (Alsaedi, Ahmed); Hayat, T (Hayat, Tasawar); Wang, XK (Wang, Xiangke)

Abstract

Clay minerals have been studied extensively due to their strong sorption and complexation ability toward various environmental pollutants. In this study, the sorption of Sr-90(II) on Na-montmorillonite was studied as a function of various environmental conditions such as pH, ionic strength, humic acid (HA) and temperature. The results indicated that the sorption of Sr-90(II) on Na-montmorillonite was strongly dependent on pH and ionic strength. The experimental data of Sr-90(II) sorption was simulated by the diffuse-layer model (DLM) well with the aid of Visual Minteq 3.0. At low pH, the sorption of Sr-90(II) was dominated by outer-sphere surface complexation and ion exchange with Na+/H+ on Na-montmorillonite surfaces, whereas inner-sphere surface complexation was the main sorption mechanism at high pH. The presence of HA enhanced Sr-90(II) sorption at pH <7.0 but decreased Sr-90(II) sorption at pH >7.0. Langmuir and Freundlich models were used to simulate the sorption isotherms of Sr-90(II) at three different temperatures of 303, 318 and 333 K. The thermodynamic parameters (Delta H, Delta S and Delta G) calculated from the temperature-dependent sorption isotherms indicated that the sorption of Sr-90(II) on Na-montmorillonite was an endothermic and spontaneous process. The thermodynamic parameters calculated from temperature-dependent sorption data were crucial to understand the interaction behavior of Sr-90(II) with Na-montmorillonite. (C) 2015 Elsevier B.V. All rights reserved.
96. Impact of the Oxide-Aperture Diameter on the Energy Efficiency, Bandwidth, and Temperature Stability of 980-nm VCSELs

Moser, P (Moser, Philip); Lott, JA (Lott, James A.); Larisch, G (Larisch, Gunter); Bimberg, D (Bimberg, Dieter)

Abstract

New oxide-confined 980-nm vertical-cavity surface-emitting lasers (VCSELs) with record temperature-stable small-signal bandwidths of 25.6 to 23.0 GHz at 25 to 85 degrees C are designed, fabricated, and characterized. Technology-based device parameters essential for system-level models of VCSEL-based short-reach and ultrashort-reach optical interconnects are extracted. These parameters include key intrinsic figures-of-merit, including the -3-dB modulation bandwidth, the bandwidth-to-electrical power ratio, and device input impedance, all as functions of temperature, oxide-aperture diameter, and desired range of bias current or current density. Further, the M-factor, relating the intrinsic VCSEL bandwidth to the error-free bit rate for a given external systems configuration and application, is introduced. Our present 980-nm VCSEL technology is capable of 40 Gb/s operation at 85 degrees C at a simultaneously low current density of 10 kA/cm^2 with an energy of only 100 fJ per bit.
97. Inductive Power Transfer System With Self-Calibrated Primary Resonant Frequency

Trigui, A (Trigui, Aref); Hached, S (Hached, Sami); Mounaim, F (Mounaim, Faycal); Ammari, AC (Ammari, Ahmed Chiheb); Sawan, M (Sawan, Mohamad)

Abstract

Inductive power transfer (IPT) is a commonly employed technique for wirelessly supplying power to implantable medical devices. A major limit of this approach is the sensitivity of the inductive link to coupling factor variations between transmitting and receiving coils. We propose in this paper a new method for compensating these variations and improving the inductive link efficiency. The proposed technique is based on a mechatronic module that dynamically tunes the primary resonant capacitor value in order to maintain the resonance state of the IPT system. The module is able to maintain resonance state for apparent primary inductance range at least from 0.5 to 5 μH using a high capacitance resolution of 0.032 pF. Experimentations conducted on a 13.56-MHz IPT system showed a 65% higher power transfer compared to a traditional IPT system.
Interaction mechanism of Eu(III) with MX-80 bentonite studied by batch, TRLFS and kinetic desorption techniques

Wang, XX (Wang, Xiangxue); Sun, YB (Sun, Yubing); Alsaedi, A (Alsaedi, Ahmed); Hayat, T (Hayat, Tasawar); Wang, XK (Wang, Xiangke)

Abstract

Speciation of surface adsorbed lanthanide/actinide ions at solid/water interface is very important for the evaluation of their physicochemical behavior in the natural environment. Herein, the sorption mechanism of Eu(III) on MX-80 bentonite is studied by batch sorption experiments, surface complexation modeling, time resolved laser fluorescence spectroscopy study (TRLFS) and kinetic dissociation measurements. The fluorescing adsorbed species are characterized with their emission spectra [the ratio of emission intensities of D-5(0) -> F-7(1) (lambda = 594 nm) and D-5(0) -> F-7(2) (lambda = 619 nm) transitions] and their fluorescence lifetime. The decrease of the intensity ratio points to the ongoing sorption/complexation with increasing pH. The increase of fluorescence lifetime with increasing pH indicates the changes from the formation of outer-sphere surface complexes to inner-sphere surface complexes. The species of adsorbed Eu(III) ions at bentonite surface are further demonstrated by surface complexation modeling, and the fitted results reveal that the sorption of Eu(III) on bentonite can be satisfactorily simulated by diffuse layer model with the strong and weak sites. The kinetic dissociation results of surface adsorbed Eu(III) from bentonite using chelating resin indicate that two different Eu-bentonite species (i.e., irreversible and reversible species) are required to explain the kinetic desorption results. The Eu species moves from the reversible to irreversible species with increasing pH values. The results are crucial to understand the physicochemical behavior of lanthanides in the natural environment.

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Interface pn junction arrays with high yielded grown p-Si microneedles by vapor-liquid-solid method at low temperature

Islam, MS (Islam, Md Shofiqul); Ishida, M (Ishida, Makoto)

Abstract

In this work we report the fabrication and investigation of the properties of interface pn junction arrays formed at the interface of vertically aligned p-Si microneedles and n-Si substrate. Arrays of boron doped p-Si microneedles were grown on n-Si substrate with the maximum yield of 100% by Au-catalysed vapor-liquid-solid (VLS) growth using in-situ doping with the mixed gas of Si2H6 and B2H6 at temperature less than 700 degrees C, which is low as compared to the temperature (1100 degrees C) required by diffusion process to dope Si microneedles after VLS growth. The physical dimension (diameter, length) and position of these p-Si microneedles can be controlled. The variation of growth rate, diameter, conductivity, impurity concentration and hole mobility of these p-Si microneedles were investigated with the variation of boron doping. The pn junctions, formed with p-Si microneedles having different diameters, were found to exhibit standard diode characteristics. These pn junction embedded Si microneedle arrays might be potential candidate in sensor area applications. Again, low temperature processing would be compatible to integrate these junction arrays with other circuitry on a chip. This work provides one step forward to realize more sophisticated vertical active devices (BJT, MOSFET, etc) with Si microneedles. (C) 2014 Elsevier Ltd. All rights reserved.
100. Investigating the characteristics of TM-pass/TE-stop polarizer designed using plasmonic nanostructures

Mahros, AM (Mahros, Amr M.); Tharwat, MM (Tharwat, Marwa M.); Ashry, I (Ashry, Islam)

Abstract

Plasmonics-based polarizers are important for many photonic devices and applications. In this paper, we design and investigate the characteristics of a new TM-pass/TE-stop polarizer using silver nanograting of exponentially tapered slit sidewalls. Performance of the designed polarizer is determined through monitoring the modification of its insertion loss, return loss, extinction ratio, and far-field transform due to changing its structural parameters. We find that the structural parameters of the reported polarizer such as a slit sidewall tapering coefficient and slit opening widths have a significant impact on tuning the polarizer characteristics. (C) 2015 Optical Society of America

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Department Name: Electrical and Computer Engineering
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Abstract

We investigate the extraordinary optical transmission spectra of thin gold films perforated with imperfect nanohole arrays using the finite difference time domain (FDTD) method. Exponential shapes for the nanohole sidewalls are used. To the best of our knowledge, such investigation of transmission spectra of imperfect nanohole arrays has not previously been demonstrated. It was found that the asymmetry between the two openings of the circular nanoholes or bending to their sidewalls strongly modifies both the intensity and resonance positions of the transmission spectra. Furthermore, the results of this study assist in explaining the technicality of extraordinary optical transmission phenomenon and why some experimental results on transmission differ from those expected.

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Research Areas: Science & Technology - Other Topics; Materials Science
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Department Name: Electrical and Computer Engineering
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102. Investigating the Optical Transmission Spectra of Plasmonic Spherical Nano-Hole Arrays

Ashry, I (Ashry, Islam); Elrashidi, A (Elrashidi, Ali); Tharwat, MM (Tharwat, Marwa M.); Xu, Y (Xu, Yong); Mahros, AM (Mahros, Amr M.)

Abstract

Plasmonic nano-structures are important for many photonic devices and applications. The optical transmission spectra of such structures are extraordinary. In this paper, we investigate the optical transmission spectra of thin gold films perforated with imperfect circular nano-hole arrays using the finite difference time domain (FDTD). It is observed that both of the intensity and resonance positions of the transmission spectra of perfect plasmonic circular nano-hole arrays are strongly modified due to nano-holes imperfection. Furthermore, we comprehensively study the transmission spectrum of plasmonic spherical nano-hole arrays as a simple example for hole imperfection.
Abstract

In this paper, investigation of the performance of a support vector machine (SVM) and artificial neural networks (ANN) in predicting solar radiation on PV panel surfaces with particular tilt angles was carried out on two sites in Saudi Arabia. The diffuse, direct, and global solar radiation data on a horizontal surface were used as the basis for predicting the radiation on a tilted surface. The amount of data used is equivalent to 360 days, averaged from the 5-min basis data. By solving the tilt angle equation, an optimum value of solar radiation was obtained using a tilt angle of 16 degrees and 37.5 degrees for Jeddah and Qassim locations, respectively. The evaluation of performance and comparison of results of ANN as well as SVM and the measured/calculated data are made on the basis of statistical measures including the root mean square error (RMSE), coefficient of correlation (CC), and magnitude of relative error (MRE). The speed of computation of the algorithms is also considered for comparison. Results indicate that for Jeddah, the CC for SVM is between 0.918 and 0.967 for training and in the range of 0.91981-0.97641 for testing while that of ANN is in the range of 0.517-0.9692 for training and 0.0361-0.0961 for testing. For Qassim, the results are even better with CC of 0.999 for training and 0.987 for testing ANN showed higher values of MRE ranging between 0.19 and 1.16 and SVM is between 0.33 and 0.51 for training and testing respectively. In terms of speed of computation, it is observed that SVM is faster than ANN in predicting solar radiation data with a lower speed of 2.15 s compared to 4.56 s for ANN during training. Moreover, SVM has lower values of RMSE indicating that it is robust and has the capability to minimize errors during computations. Therefore, SVM has significantly higher accuracy, robust during computation and is faster in predicting the radiation on the tilted surfaces in comparison with ANN. (C) 2015 Elsevier Ltd. All rights reserved.
Department Name: Electrical and Computer Engineering
DSR No.: 4544
Investigation on cellular-automata irregular-fractal ultrawideband slot-antennas

Ladhar, L (Ladhar, Lotfi); Zarouan, M (Zarouan, Mohamed); Oueslati, D (Oueslati, Donia); Floch, JM (Floch, Jean-Marie); Rmili, H (Rmili, Hatem)

Abstract

In this article, the effect of an irregular-fractal slot added to a radiating square patch of an ultrawideband (UWB) printed antenna is studied. The fractal complex-shaped slot was generated randomly by applying the Cellular-Automata technique. Analysis of both simulated and measured results dealing with the impedance matching, surface currents, gain, and radiation patterns shows three different behaviors: improvement, mismatching, or rejection of one or two bands, depending on the shape and position of the slot. It is found also that the gain of the UWB-antenna can be enhanced for some particular shaped slots. (c) 2015 Wiley Periodicals, Inc. Microwave Opt Technol Lett 55:2506-2514, 2015
105. Iterative Dynamic Water-Filling for Fading Multiple-Access Channels With Energy Harvesting

Wang, Z (Wang, Zhe); Aggarwal, V (Aggarwal, Vaneet); Wang, XD (Wang, Xiaodong)

Abstract

In this paper, we develop optimal energy scheduling algorithms for N-user fading multiple-access channels with energy harvesting to maximize the channel sum-rate, assuming that the side information of both the channel states and energy harvesting states for K time slots is known a priori, and the battery capacity and the maximum energy consumption in each time slot are bounded. The problem is formulated as a convex optimization problem with O(NK) constraints making it hard to solve using a general convex solver since the computational complexity of a generic convex solver becomes impractically high when the number of constraints is large. This paper gives an efficient energy scheduling algorithm, called the iterative dynamic water-filling algorithm, that has a computational complexity of O(NK2) per iteration. For the single-user case, a dynamic water-filling method is shown to be optimal. Unlike the traditional water-filling algorithm, in dynamic water-filling, the water level is not constant but changes when the battery overflows or depletes. An iterative version of the dynamic water-filling algorithm is shown to be optimal for the case of multiple users. Even though in principle the optimality is achieved under large number of iterations, in practice convergence is reached in only a few iterations. Moreover, a single iteration of the dynamic water-filling algorithm achieves a sum-rate that is within (N - 1) K nats of the optimal sum-rate.
Abstract

This paper is concerned with the optimal Kalman filtering problem for a class of discrete stochastic systems with multiplicative noises and random two-step sensor delays. Three Bernoulli distributed random variables with known conditional probabilities are introduced to characterize the phenomena of the random two-step sensor delays which may happen during the data transmission. By using the state augmentation approach and innovation analysis technique, an optimal Kalman filter is constructed for the augmented system in the sense of the minimum mean square error (MMSE). Subsequently, the optimal Kalman filtering is derived for the corresponding augmented system in initial instants. Finally, a simulation example is provided to demonstrate the feasibility and effectiveness of the proposed filtering method.
107. Knowledge representation through graphs

Portmann, E (Portmann, Edy); Kaltenrieder, P (Kaltenrieder, Patrick); Pedrycz, W (Pedrycz, Witold)

Abstract

Due to the increasing amount of data, knowledge aggregation, representation and reasoning are highly important for companies. In this paper, knowledge aggregation is presented as the first step. In the sequel, successful knowledge representation, for instance through graphs, enables knowledge-based reasoning. There exist various forms of knowledge representation through graphs; some of which allow to handle uncertainty and imprecision by invoking the technology of fuzzy sets. The paper provides an overview of different types of graphs stressing their relationships and their essential features. An example is included for didactical reasons. (C) 2015 The Authors. Published by Elsevier B.V.
108. Launching OAM-Carrying Waves by a Leaky Circular Current Loop

Salem, MA (Salem, Mohamed A.); Caloz, C (Caloz, Christophe)

Abstract

We rigorously analyze the electromagnetic field radiated by a leaky circular current loop. The analysis establishes that this simple structure is capable of launching orbital angular momentum (OAM)-carrying waves, which may be employed for communication applications. The leaky loop may also be employed to model one of the radiating modes of a circular leaky wave antenna (CLWA). The analysis employs a polar transmission representation along with a Kontorovich-Lebedev transform to derive integral representations of the radiated field.

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Reprint Address: Salem, MA (reprint author), Polytech Montreal, Dept Elect Engn, Montreal, PQ H2T 1J3, Canada.
Publisher: IEEE
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 7487
# 109. Lexicographic Multiobjective Integer Programming for Optimal and Structurally Minimal Petri Net Supervisors of Automated Manufacturing Systems

Huang, B (Huang, Bo); Zhou, MC (Zhou, MengChu); Zhang, GX (Zhang, GongXuan); Ammari, AC (Ammari, Ahmed Chiheb); Alabdulwahab, A (Alabdulwahab, Ahmed); Fayoumi, AG (Fayoumi, Ayman G.)

**Abstract**

Based on Petri net (PN) models of automated manufacturing systems, this paper proposes a deadlock prevention method to obtain a maximally permissive (optimal) supervisor while minimizing its structure. The optimal supervisor can be achieved by forbidding all first-met bad markings (FBMs) and permitting all legal markings in a PN model. An FBM obtained via a single transition's firing at a legal marking is a deadlock or marking that inevitably evolves into a deadlock. A lexicographic multiobjective integer programming problem with multiple objectives to be achieved sequentially is formulated to design such an optimal and structurally minimal supervisor. As a nonlinear function, the quantity of its directed arcs is minimized. A conversion method is proposed to convert the nonlinear model into a linear one. With the premise that each place in the supervisor is associated with a nonnegative place invariant, the controlled net holds all legal markings of the net model, and the supervisor has the minimal structure. Finally, some examples are used to illustrate the application of the proposed approach.

**Sources**

<table>
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**Research Areas**

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**Faculty Name**

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**Department Name**

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4785
110. Magnetless Ring Circulator based on Nonreciprocal Phasers
Chamanara, N (Chamanara, Nima); Caloz, C (Caloz, Christophe)

Abstract

A novel ring circulator, based on three loss-less reciprocal T-junctions and three nonreciprocal phasers, potentially providing huge bandwidth, is introduced. This circulator mimics the operation of a ferrite circulator, where coupled counter-rotating modes constructively and destructively interfere at the transmission and isolation ports, respectively. It may be implemented in a planar form with convenient electric DC bias and without resorting to magnetic materials.

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Reprint Address: Chamanara, N (reprint author), Polytech Montreal, Dept Elect Engn, Montreal, PQ H2T 1J3, Canada.
Publisher: IEEE
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 7491
Maximizing the temperature insensitivity, energy efficiency, and bit rate of 980-nm VCSELs via small oxide-aperture diameters and photon lifetime tuning

Moser, P (Moser, Philip); Volwahsen, M (Volwahsen, Maya); Larisch, G (Larisch, Gunter); Lott, JA (Lott, James A.); Bimberg, D (Bimberg, Dieter)

Abstract

Energy-efficient oxide-confined vertical-cavity surface-emitting lasers (VCSELs) emitting at 980 nm, particularly well suited for optical interconnects operating at up to 85 degrees C are presented. The modulation bandwidth $f_{3\text{dB}}$ of our VCSELs increases at low currents with increasing temperature up to 23 GHz at 85 degrees C. The impact of cavity photon lifetime and oxide-aperture diameter on the energy efficiency, temperature stability, and static and dynamic properties of our VCSELs are analyzed. Error-free 40 Gb/s operation at 85 degrees C with an energy-to-data ratio below 100 fJ/bit and a current density close to 10 kA/cm$^2$ is predicted based on small signal modulation experiments.

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Language: English
Reprint Address: Moser, P (reprint author), Tech Univ Berlin, Inst Festkorperphys, Hardenbergstr 36, D-10623 Berlin, Germany.
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Web of Science Categories: Optics; Physics, Applied
Research Areas: Optics; Physics
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 8017
112. Metamaterial RFID Tag Designs For Long Read Range

Hamzaoui, D (Hamzaoui, D.); Vuong, TP (Vuong, T. P.); Djahli, F (Djahli, F.); Kiani, GI (Kiani, G. I.)

Abstract

A novel high gain metamaterial tag antenna for European UHF RFID is proposed. First a modified dog bone AMC unit cell and a meander dipole antenna are designed separately to operate in 865.6-867.6 MHz frequency band, then the effect of adding an AMC to design is investigated. The realized gain increased from 1.8 dB for the antenna alone to 4.17 dB for the metamaterial antenna constituted of 1 x 2 unit cells. A total efficiency of 90 % is observed at 868 MHz. Then the effect of increasing the number of unit cells of AMC on the performance of the tag antenna in terms of gain, bandwidth and radiation efficiency is studied. By increasing the unit cells to 2x3, the antenna gain increases to 7.66 dB with an efficiency of 95.78 %, hence increasing the read range. The structure is low cost and easy to fabricate.
113. MHD peristaltic transport of spherical and cylindrical magneto-nanoparticles suspended in water

Abbasi, FM (Abbasi, F. M.); Hayat, T (Hayat, T.); Alsaadi, F (Alsaadi, Fuad); Dobai, AM (Dobai, Abdullah M.); Gao, HJ (Gao, Huijun)

Abstract

Advancements in the biomedical engineering have enhanced the usage of magneto-nanoparticles in improving the precision and efficiency of the magneto-drug delivery systems. Such systems make use of the externally applied magnetic fields to direct the drug towards a specific target in the human body. Peristalsis of magneto-nanofluids is of significant importance in such considerations. Hence peristaltic transport of Fe3O4-water nanofluid through a two-dimensional symmetric channel is analyzed in the presence of an externally applied constant magnetic field. Hamilton-Crosser's model of the thermal conductivity is utilized in the problem development. The nanofluid saturates a non-uniform porous medium in which the porosity of the porous medium varies with the distance from the channel walls. Analysis is performed for the spherical and the cylindrical nanoparticles. Resulting system of equations is numerically solved. Impacts of sundry parameters on the axial velocity, temperature, pressure gradient and heat transfer rate at the boundary are examined. Comparison between the results for spherical and cylindrical nanoparticles is also presented. Results show that the nanoparticles volume fraction and the Hartman number have increasing effect on the pressure gradient throughout the peristaltic tract. Effective heat transfer rate at the boundary tends to enhance with an increase in the nanoparticles volume fraction. Use of spherical nanoparticles results in a higher value of axial velocity and the temperature at the center of channel when compared with the case of cylindrical nanoparticles. (C) 2015 Author(s).
Model Predictive Control of Central Chiller Plant With Thermal Energy Storage Via Dynamic Programming and Mixed-Integer Linear Programming

Deng, K (Deng, Kun); Sun, Y (Sun, Yu); Li, SS (Li, Sisi); Lu, Y (Lu, Yan); Brouwer, J (Brouwer, Jack); Mehta, PG (Mehta, Prashant G.); Zhou, MC (Zhou, MengChu); Chakraborty, A (Chakraborty, Amit)

Abstract

This work considers the optimal scheduling problem for a campus central plant equipped with a bank of multiple electrical chillers and a thermal energy storage (TES). Typically, the chillers are operated in ON/OFF modes to charge TES and supply chilled water to satisfy the campus cooling demands. A bilinear model is established to describe the system dynamics of the central plant. A model predictive control (MPC) problem is formulated to obtain optimal set-points to satisfy the campus cooling demands and minimize daily electricity cost. At each time step, the MPC problem is represented as a large-scale mixed-integer nonlinear programming problem. We propose a heuristic algorithm to obtain suboptimal solutions for it via dynamic programming (DP) and mixed integer linear programming (MILP). The system dynamics is linearized along the simulated trajectories of the system. The optimal TES operation profile is obtained by solving a DP problem at every horizon, and the optimal chiller operations are obtained by solving an MILP problem at every time step with a fixed TES operation profile. Simulation results show desired performance and computational tractability of the proposed algorithm. Note to Practitioners- This work was motivated by the supervisory control need for a campus central plant. Plant operators have to decide a scheduling strategy to mix and match various chillers with a thermal energy storage to satisfy the campus cooling demands, while minimizing the operation cost. This work mathematically characterizes the system dynamics of a campus central plant and establishes a linear model to predict campus cooling load. It proposes a model predictive control (MPC) strategy to optimally schedule the campus central plant based on plant system dynamics and predicted campus cooling load. A heuristic algorithm is proposed to obtain suboptimal solutions for the MPC problem. The effectiveness and efficiency of the proposed approach are well demonstrated for the central plant at the University of California, Irvine.
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Research Areas: Automation & Control Systems
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 6631
Abstract

This paper considers the problem of model reduction of a class of discrete-time systems subject to Lipschitzian nonlinearities. It is shown that under some conditions the nonlinear system can be either approximated by a discrete-time linear time-invariant system or a nonlinear system of reduced order. The computation of the matrices of the reduced-order system is carried out through the solutions of a set of linear matrix inequalities. The proposed design is approved by the simulation of reduced-order dynamics of a mass-spring system subject to a nonlinear friction and a linear electric circuit with uncertain parameters. (C) 2014 Elsevier Inc. All rights reserved.
Modulation bandwidth and energy efficiency of metallic cavity semiconductor nanolasers with inclusion of noise effects

Ding, K (Ding, K.); Diaz, JO (Diaz, J. O.); Bimberg, D (Bimberg, D.); Ning, CZ (Ning, C. Z.)

Abstract

Modulation bandwidth and energy efficiency of metallic cavity nanolasers are studied in both small signal and digital modulation formats. Special emphasis is placed on the effects of noise on data rate and energy efficiency. It is found that the data rate for nanolasers of small sizes is severely limited by noise-induced bit-error rate. The trade-off between size-reduction and noise effects leads to an optimal cavity size to achieve the highest data rate. The energy data-rate ratio decreases in general with device size, but starts to increase in ultrasmall devices, due to increased threshold current and noise effects. However, relatively high modulation rate and energy efficiency can be achieved in metallic cavity nanolasers. Calculations show that a low energy consumption of 30 fJ/bit at a high data rate of 120 Gbit/s can be realized in nanolasers as small as \( V = 16 (\lambda/n(r))^3 \) (\( V \) is the laser cavity volume). Ultralow energy consumption per bit (<10 fJ/bit) does require smaller devices (\( V < 2.1 (\lambda/n(r))^3 \)), while the noise limits the data rate to below 50 Gbit/s. Such a balanced and holistic consideration between device size, data rate, noise effects, and energy efficiency offers new perspectives to nanolaser design strategy for future onchip integrated nanophotonics systems.
117. Modulation Techniques to Reduce Leakage Current in Three-Phase Transformerless H7 Photovoltaic Inverter

Freddy, TKS (Freddy, Tan Kheng Suan); Rahim, NA (Rahim, Nasrudin A.); Hew, WP (Hew, Wooi-Ping); Che, HS (Che, Hang Seng)

Abstract

Recently, reduced common-mode voltage (CMV) pulsewidth modulation (RCMV-PWM) methods have been proposed to reduce the leakage current in three-phase transformerless photovoltaic (PV) systems. However, most of these studies only focus on leakage current elimination and neglect the overall performance of the PV systems on issues such as cost, voltage linearity, dc-link current ripples, and harmonic distortion. In this paper, a three-phase transformerless inverter, adapted from the single-phase H5 topology, is investigated. Since the H5 topology has been conventionally developed for a single-phase system, its adaptation to the three-phase system requires the development of corresponding three-phase modulation techniques. Hence, modulation techniques are proposed based on conventional PWM. The performances of the proposed PWM, in terms of CMV, leakage current, voltage linearity, output current ripples, dc-link current ripples, and harmonic distortion are studied and discussed via simulation and experiment. It is proven that the proposed topology is able reduce the leakage current without sacrificing the overall performance of the system.

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Research Areas: Automation & Control Systems; Engineering; Instruments & Instrumentation
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 8345
118. Multistep Fuzzy Bridged Refinement Domain Adaptation Algorithm and Its Application to Bank Failure Prediction
Behbood, V (Behbood, Vahid); Lu, J (Lu, Jie); Zhang, GQ (Zhang, Guangquan); Pedrycz, W (Pedrycz, Witold)

Abstract

Machine learning plays an important role in data classification and data-based prediction. In some real-world applications, however, the training data (coming from the source domain) and test data (from the target domain) come from different domains or time periods, and this may result in the different distributions of some features. Moreover, the values of the features and/or labels of the datasets might be nonnumeric and involve vague values. Traditional learning-based prediction and classification methods cannot handle these two issues. In this study, we propose a multistep fuzzy bridged refinement domain adaptation algorithm, which offers an effective way to deal with both issues. It utilizes a concept of similarity to modify the labels of the target instances that were initially predicted by a shift-unaware model. It then refines the labels using instances that are most similar to a given target instance. These instances are extracted from mixture domains composed of source and target domains. The proposed algorithm is built on a basis of some data and refines the labels, thus performing completely independently of the shift-unaware prediction model. The algorithm uses a fuzzy set-based approach to deal with the vague values of the features and labels. Four different datasets are used in the experiments to validate the proposed algorithm. The results, which are compared with those generated by the existing domain adaptation methods, demonstrate a significant improvement in prediction accuracy in both the above-mentioned datasets.

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Web of Science Categories: Computer Science, Artificial Intelligence; Engineering, Electrical & Electronic
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Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 4399
119. New results on robust finite-time boundedness of uncertain switched neural networks with time-varying delays

Wang, S (Wang, Shun); Shi, TG (Shi, Tiange); Zeng, M (Zeng, Ming); Zhang, LX (Zhang, Lixian); Alsaadi, FE (Alsaadi, Fuad E.); Hayat, T (Hayat, Tasawar)

Abstract

This paper investigates the finite-time boundedness (FIB) problem for a class of uncertain switched neural networks with time-varying delays. By exploring the mode-dependent properties of each subsystem, all the subsystems could be categorized into stable and unstable ones under the Lyapunov-like function framework. The sufficient conditions and a set of unified switching signals with average dwell time (ADT) are first derived with a known limit to the total activation time ratio between unstable and stable subsystems. Then, the obtained results are extended to a new switching approach with mode-dependent average dwell time (MDADT). Compared with general results, our proposed approach distinguishes the stable and unstable subsystems rather than viewing all subsystems as being unstable, thus getting less conservative switching criteria. Finally, a numerical example is provided to show the validity and the advantages of the finding techniques. (C) 2014 Elsevier B.V. All rights reserved.

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Publisher : ELSEVIER SCIENCE BV
Web of Science Categories : Computer Science, Artificial Intelligence
Research Areas : Computer Science
Faculty Name : Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No. : 6824
120. Non-linear modelling and stability analysis of resonant DC-DC converters

Mandal, K (Mandal, Kuntal); El Aroudi, A (El Aroudi, Abdelali); Abusorrah, A (Abusorrah, Abdullah); Al-Hindawi, M (Al-Hindawi, M.); Al-Turki, Y (Al-Turki, Yusuf); Giaouris, D (Giaouris, Damian); Banerjee, S (Banerjee, Soumitro)

Abstract

Resonant dc-dc converters have found increasing application in industry in recent times. Yet, the methods of dynamical analysis and parameter design for this kind of system are not well developed. The averaging method cannot be used in such converters as the small-ripple assumption does not hold. The sampled-data model, which seeks to obtain a closed form expression of the state at a clock instant in terms of that at the previous clock instant, also becomes unwieldy for converters with many topological modes - a condition prevailing in all resonant converters. In this study the authors show that the Filippov method can be effectively applied for accurate s-domain small signal analysis as well as time domain stability analysis by locating the stability boundaries in the parameter space for such systems. The authors apply this method to three classes of resonant converters - the switch resonant converter, the resonant transition converter and the load resonant converter - and present the mechanisms by which these converters may lose stability as the parameters are varied. The theoretical results corresponding to the resonant transition converter are validated experimentally.

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Publisher: INST ENGINEERING TECHNOLOGY-IET
Web of Science Categories: Engineering, Electrical & Electronic
Research Areas: Engineering
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 4371
121. Nonlinear observer design for PEM fuel cell power systems via second order sliding mode technique

Liu, JX (Liu, Jianxing); Lin, WY (Lin, Weiyang); Alsaadi, F (Alsaadi, Fuad); Hayat, T (Hayat, Tasawar)

Abstract

In this paper, a nonlinear observer is proposed for a PEMFC system, based on Second Order Sliding Mode (SOSM) techniques. The goal is to estimate the hydrogen partial pressure in the anode channel of the PEMFC, using the measurements of stack voltage, stack current, anode pressure and anode inlet pressure. The proposed observer employs a nonlinear error injection term, where the error is obtained from the difference between the system voltage output obtained from an experimental validated nonlinear model and estimated voltage output obtained from the designed observer. The robustness of this observer against parametric uncertainties and load variations is studied, and the finite time convergence property is proved via Lyapunov analysis. Simulation results illustrate the effectiveness and robustness of the proposed approach. (C) 2015 Elsevier B.V. All rights reserved.
Nonlinear tracking control based on extended state observer for vehicle active suspensions with performance constraints

Pan, HH (Pan, Huihui); Sun, WC (Sun, Weichao); Gao, HJ (Gao, Huijun); Hayat, T (Hayat, Tasawar); Alsaadi, F (Alsaadi, Fuad)

Abstract

In this paper, a nonlinear tracking control strategy with extended state observer (ESO) is presented for vehicle active suspensions to improve the ride comfort, where suspension spaces, dynamic tire loads are considered as time-domain constraints to be guaranteed. The unique characteristic of the proposed approach lies in the independence on accurate mathematical model. More exactly, the unknown dynamics and external disturbances of the vehicle suspension are regarded as an augmented state of the system and are estimated using the designed ESO. The stability analysis shows that both the estimation error and the tracking error of the control output are bounded and that the upper bounds of the errors monotonously decrease with the increase of the observer bandwidth. Finally, a competitive experiment on a quarter-car suspension prototype is given to demonstrate the effectiveness of the proposed control schemes. (C) 2014 Elsevier Ltd. All rights reserved.
123. On peristaltic motion of pseudoplastic fluid in a curved channel with heat/mass transfer and wall properties

Hina, S (Hina, S.); Mustafa, M (Mustafa, M.); Hayat, T (Hayat, T.); Alotaibi, ND (Alotaibi, Naif D.)

Abstract

This work addresses the combined effect of wall properties and heat/mass transfer on the peristaltic motion of pseudoplastic (shear-thinning/shear-thickening) fluid in a curved channel. The mathematical model is simplified through the assumption of long wavelength of the peristaltic wave compared to the mean half-width of the channel. Series solutions for stream function, temperature and concentration of species are derived. In contrast to the case of planar channel, the profiles are not symmetric about the central line of the curved channel. The size of the trapped bolus is different in the upper and lower halves of the curved channel. Moreover the number of circulations increase/decrease in the upper/lower half of the channel when the case of planar channel is approached. (C) 2015 Elsevier Inc. All rights reserved.
124. On Scalar Products and Decomposition Theorems of Fuzzy Soft Sets

Feng, F (Feng, Feng); Pedrycz, W (Pedrycz, Witold)

Abstract

Fuzzy soft sets realize a hybrid soft computing model in which the methods of gradualness and parametrization for dealing with uncertainty are combined effectively. Up to now, fuzzy soft sets have shown to be useful in various fields such as algebra, logic, data mining, supply chains risk management, forecasting, prediction and decision making under uncertainty. Also it is well-known that the level set approach and decomposition theorems play an important role in investigating fuzzy concepts or structures. Thus decomposition of fuzzy soft sets is a meaningful research topic from both theoretical and practical viewpoints. Nevertheless, so far as we know very few works contribute to this important issue. The present study endeavors to fill this blank in the theory of fuzzy soft sets. It offers a systematic investigation of scalar products of fuzzy soft sets. Particularly it is shown that scalar product operations can be regarded as semimodule actions and algebraic structures like ordered idempotent semimodules of fuzzy soft sets over ordered semirings can be constructed. Also the collection of all t-level soft sets of a fuzzy soft set can form a distributive lattice under soft union and intersection operations. Finally, some decomposition theorems for fuzzy soft sets are established using scalar products and level soft sets with either constant thresholds or variable thresholds given by fuzzy sets.
125. Optimal Discrete Power Control in Poisson-Clustered Ad Hoc Networks

Liu, CH (Liu, Chun-Hung); Rong, BY (Rong, Beiyu); Cui, SG (Cui, Shuguang)

Abstract

Power control in a digital handset is practically implemented in a discrete fashion, and usually, such a discrete power control (DPC) scheme is suboptimal. In this paper, we first show that in a Poison-distributed ad hoc network, if DPC is properly designed with a certain condition satisfied, it can strictly work better than no power control (i.e., users use the same constant power) in terms of average signal-to-interference ratio, outage probability, and spatial reuse. This motivates us to propose an N-layer DPC scheme in a wireless clustered ad hoc network, where transmitters and their intended receivers in circular clusters are characterized by a Poisson cluster process on the plane $R^2$. The cluster of each transmitter is tessellated into N-layer annuli with transmit power $P_i$ adopted if the intended receiver is located at the $i$th layer. Two performance metrics of transmission capacity (TC) and outage-free spatial reuse factor are redefined based on the N-layer DPC. The outage probability of each layer in a cluster is characterized and used to derive the optimal power scaling law $P_i$ is an element of $\Theta(\eta(-(a/2))(i))$, with $\eta(i)$ as the probability of selecting power $P_i$ and $a$ as the path loss exponent. Moreover, the specific design approaches to optimize $P_i$ and $N$ based on $\eta(i)$ are also discussed. Simulation results indicate that the proposed optimal N-layer DPC significantly outperforms other existing power control schemes in terms of TC and spatial reuse.

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126. Optimal fractional order PID controller for automatic
generation control of two-area power systems

Ismayil, C (Ismayil, Chathoth); Kumar, RS (Kumar, Ramdas Sreerama); Sindhu, TK
(Sindhu, Thiruthimana Krishnan)

Abstract

This paper proposes a fractional order PID (FOPID) controller for the supplementary automatic
generation control (AGC) of two area thermal power systems. To establish the effectiveness of the
proposed controller, its dynamic performance is compared with integral/PI controllers. The parameters
of the PI controllers are determined using genetic algorithm (GA) and fuzzy logic-based approaches.
These comparisons are performed in terms of two time domain performance indices viz., settling time
and maximum overshoot/undershoot of the dynamic response and three error indices, viz., Integral of
Time multiplied Absolute Error (ITAE), Integral of the Absolute Error (IAE) and Integral of the square error
(ISE). Copyright (C) 2014 John Wiley & Sons, Ltd.
127. Optimal scheduling of distributed battery storage for enhancing the security and the economics of electric power systems with emission constraints

Haddadian, G (Haddadian, G.); Khalili, N (Khalili, N.); Khodayar, M (Khodayar, M.); Shahidehpour, M (Shahidehpour, M.)

Abstract

In this paper, the sustainable day-ahead scheduling of electric power systems with the integration of distributed energy storage devices is investigated. The main objective is to minimize the hourly power system operation cost with a cleaner, socially responsible, and sustainable generation of electricity. Emission constraints are enforced to reduce the carbon footprint of conventional thermal generating units. The stationary electric vehicles (EV) are considered as an example of distributed storage and vehicle to grid (V2G) technology is considered to demonstrate the bilateral role of EV as supplier and consumer of energy. Battery storage can ease the impact of variability of renewable energy sources on power system operations and reduce the impact of thermal generation emission at peak hours. We model the day-ahead scheduling of electric power systems as a mixed-integer linear programing (MILP) problem for solving the hourly security-constraint unit commitment (SCUC). In order to expedite the real-time solution for large-scale power systems, we consider a two-stage model of the hourly SCUC by applying the Benders decomposition (BD). The Benders decomposition would separate the hourly generation unit commitment (UC) in the master problem from the power network security check in subproblem. The subproblem would check dc network security constraints for the given UC solution to determine whether a converged and secure dc power flow can be obtained. If any power network violations arise, corresponding Benders cuts are formed and added to the master problem for solving the next iteration of UC. The iterative process will continue until the network violations are eliminated and a converged hourly solution is found for scheduling the power generating units. Numerical simulations are presented to illustrate the effectiveness of the proposed MILP approach and its potentials as an optimization tool for sustainable operations of electric power grids. (C) 2015 Elsevier B.V. All rights reserved.
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 5926
128. Optimal sizing of grid-connected photovoltaic energy system in Saudi Arabia
Ramli, MAM (Ramli, Makbul A. M.); Hiendro, A (Hiendro, Ayong); Sedraoui, K (Sedraoui, Khaled); Twaha, S (Twaha, Ssennoga)

Abstract

Resource optimization is a major factor in the assessment of the effectiveness of renewable energy systems. Various methods have been utilized by different researchers in planning and sizing the grid-connected PV systems. This paper analyzes the optimal photovoltaic (PV) array and inverter sizes for a grid-connected PV system. Unmet load, excess electricity, fraction of renewable electricity, net present cost (NPC) and carbon dioxide (CO2) emissions percentage are considered in order to obtain optimal sizing of the grid-connected PV system. An optimum result, with unmet load and excess electricity of 0%, for serving electricity in Makkah, Saudi Arabia is achieved with the PV inverter size ratio of R = 1 with minimized CO2 emissions. However, inverter size can be downsized to 68% of the PV nominal power to reduce the inverter cost, and hence decrease the total NPC of the system. (C) 2014 Elsevier Ltd. All rights reserved.
129. Optimized face recognition algorithm using radial basis function neural networks and its practical applications

Yoo, SH (Yoo, Sung-Hoon); Oh, SK (Oh, Sung-Kwun); Pedrycz, W (Pedrycz, Witold)

Abstract

In this study, we propose a hybrid method of face recognition by using face region information extracted from the detected face region. In the preprocessing part, we develop a hybrid approach based on the Active Shape Model (ASM) and the Principal Component Analysis (PCA) algorithm. At this step, we use a CCD (Charge Coupled Device) camera to acquire a facial image by using AdaBoost and then Histogram Equalization (HE) is employed to improve the quality of the image. ASM extracts the face contour and image shape to produce a personal profile. Then we use a PCA method to reduce dimensionality of face images. In the recognition part, we consider the improved Radial Basis Function Neural Networks (RBF NNs) to identify a unique pattern associated with each person. The proposed RBF NN architecture consists of three functional modules realizing the condition phase, the conclusion phase, and the inference phase completed with the help of fuzzy rules coming in the standard ‘if-then’ format. In the formation of the condition part of the fuzzy rules, the input space is partitioned with the use of Fuzzy C-Means (FCM) clustering. In the conclusion part of the fuzzy rules, the connections (weights) of the RBF NNs are represented by four kinds of polynomials such as constant, linear, quadratic, and reduced quadratic. The values of the coefficients are determined by running a gradient descent method. The output of the RBF NNs model is obtained by running a fuzzy inference method. The essential design parameters of the network (including learning rate, momentum coefficient and fuzzification coefficient used by the FCM) are optimized by means of Differential Evolution (DE). The proposed P-RBF NNs (Polynomial based RBF NNs) are applied to facial recognition and its performance is quantified from the viewpoint of the output performance and recognition rate. (C) 2015 Elsevier Ltd. All rights reserved.
130. Optimized Parallel Model of Covariance Based Person Detection

Abid, N (Abid, Nesrine); Loukil, K (Loukil, Kais); Ayedi, W (Ayedi, Walid); Ammari, AC (Ammari, Ahmed Chiheb); Abid, M (Abid, Mohamed)

Abstract

Covariance descriptor has good performance for person detection systems. However, it has high execution time. Multiprocessors systems are usually adopted to speed up the execution of these systems. In this paper, an optimized parallel model for covariance person detection is implemented using a high-level parallelization procedure. The main characteristics of this procedure are the use of Khan Process Network (KPN) parallel programming model of computation, and the exploration of both task and data levels of parallelism. For this aim, a first KPN parallel model is proposed starting from the block diagram of the covariance person detection application. This model is implemented through the Y-Chart Application Programmers Interface (YAPI) C++ library. To ensure the best workload balance of the optimized model, communication and computation workload analysis are considered. Based on these results, both task merging and data-level partitioning are explored to derive an optimized model with the best communication and computation workload balance. The optimized parallel model obtained has three times lower execution time in comparison with the sequential model.

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Parameter estimation of Takagi-Sugeno fuzzy system using heterogeneous cuckoo search algorithm

Ding, XM (Ding, Xueming); Xu, ZK (Xu, Zhenkai); Cheung, NJ (Cheung, Ngaam J.); Liu, XH (Liu, Xiaohui)

Abstract

In this paper, a novel method, called intelligent Takagi-Sugeno Modeling (iTaSuM), for identifying the structure and parameters of T-S fuzzy system is developed based on heterogeneous cuckoo search algorithm (HeCoS) to overcome the drawbacks that classical cuckoo search algorithm. HeCoS is a new variant of cuckoo search algorithm with heterogeneous searching strategies based on the quantum mechanism. Through the experimental analysis, we demonstrate that the proposed algorithm has a balance between exploration and exploitation. Comparing with other existing methods, we achieve that iTaSuM can generate good fuzzy system model with high accuracy and strong generalization ability. (C) 2014 Elsevier B.V. All rights reserved.
Peristalsis in a curved channel with slip condition and radial magnetic field

Shehzad, SA (Shehzad, S. A.); Abbasi, FM (Abbasi, F. M.); Hayat, T (Hayat, T.);
Alsaadi, F (Alsaadi, F.); Mousa, G (Mousa, G.)

Abstract

Impact of radially varying applied magnetic field on the peristaltic transport of a Carreau-Yasuda (CY) fluid through a curved channel is examined. Analysis is performed when the no-slip condition does not hold. Long wavelength and low Reynolds number approximations are taken into consideration in the mathematical formulation of the problem. Both differential equation and boundary condition are nonlinear. Resulting nonlinear equation subject to the nonlinear boundary conditions are numerically solved with Runge-Kutta fourth order with numerical Shooting. Impacts of sundry parameters on the quantities of interest are analyzed through plots. Results show that plots of the axial velocity are not symmetric about the center line for flow through curved conduits. Consequently the fluid flowing through a curved channel exerts additional stress on the inner wall of the curved channel. Such symmetry is restored when we move from curved to straight channel. Maximum fluid velocity decreases with an increase in the strength of applied magnetic field and the velocity slip parameter. Further the stress at the inner wall reduces by increasing the value of curvature parameter. (C) 2015 Elsevier Ltd. All rights reserved.
Petrologic Characteristics of the Lunar Surface

Wang, XM (Wang, Xianmin); Pedrycz, W (Pedrycz, Witold)

Abstract

Petrologic analysis of the lunar surface is critical for determining lunar formation and evolution. Here, we report the first global petrologic map that includes the five most important lunar lithological units: the Ferroan Anorthositic (FAN) Unit, the Magnesian Suite (MS) Unit, the Alkali Suite (AS) Unit, the KREEP Basalt (KB) Unit and the Mare Basalt (MB) Unit. Based on the petrologic map and focusing on four long-debated and important issues related to lunar formation and evolution, we draw the following conclusions from the new insights into the global distribution of the five petrologic units: (1) there may be no petrogenetic relationship between MS rocks and KB; (2) there may be no petrogenetic link between MS and AS rocks; (3) the exposure of the KREEP component on the lunar surface is likely not a result of MB volcanism but is instead mainly associated with the combined action of plutonic intrusion, KREEP volcanism and celestial collision; (4) the impact size of the South Pole-Aitken basin is constrained, i.e., the basin has been excavated through the whole crust to exhum a vast majority of lower-crustal material and a very limited mantle components to the lunar surface.

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PLANAR SQUARE MULTIBAND FREQUENCY RECONFIGURABLE MICROSTRIP FED ANTENNA WITH QUADRATIC KOCH-ISLAND FRACTAL SLOT FOR WIRELESS DEVICES

Ben Trad, I (Ben Trad, Imen); Rmili, H (Rmili, Hatem); Floch, JM (Floch, Jean Marie); Zouch, W (Zouch, Wassim); Drissi, M (Drissi, Mohamed)

Abstract

A planar printed multiband microstrip fed antenna with reconfigurable frequency performance was designed for multistandard wireless communication systems. The antenna consists on a square shaped patch with an optimized centered Koch-Island fractal slot. The antenna allows a reconfigurability of the frequency bands by incorporating 16 PIN diodes inside the fractal slot which is highly complex. That is why short and open circuits will be used to produce frequency agility instead of RF switches (for proof of the concept). The proposed antenna is capable to switch between 15 operating frequency bands centered at 1.7, 1.77, 2.36, 2.43, 3.30, 3.61, 3.67, 3.79, 4.05, 4.34, 4.59, 5.2, 5.27, 5.47, and 5.57 GHz through four operating modes M1-M4 over the wide range 1-6 GHz. Prototypes corresponding to different modes were manufactured and characterized. Simulated and measured results are presented and discussed. (c) 2015 Wiley Periodicals, Inc. Microwave Opt Technol Lett 57:207-212, 2015

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Abstract

Energy harvester-based cognitive radio is a promising solution to address the shortage of both spectrum and energy. Since the spectrum access and power consumption patterns are interdependent, and the power value harvested from certain environmental sources are spatially correlated, the new power dimension could provide additional information to enhance the spectrum sensing accuracy. In this paper, the Markovian behavior of the primary users is considered, based on which we adopt a hidden input Markov model to specify the primary versus secondary dynamics in the system. Accordingly, we propose a 2-D spectrum and power (harvested) sensing scheme to improve the primary user detection performance, which is also capable of estimating the primary transmit power level. Theoretical and simulated results demonstrate the effectiveness of the proposed scheme, in term of the performance gain achieved by considering the new power dimension. To the best of our knowledge, this is the first work to jointly consider the spectrum and power dimensions for the cognitive primary user detection problem.
136. Real-Time 2-D Spectral-Decomposition using a Leaky-Wave Antenna Array with Dispersive Feeding Network

Gupta, S (Gupta, Shulabh); Caloz, C (Caloz, Christophe)

Abstract

An array of leaky-wave antennas (LWA) fed with a dispersive feeding network is proposed to decompose, in real-time, the spectral components of a broadband signal in two dimensions of space. Compared to typical real-time decomposition systems, which are restricted to one-dimensional decomposition, such a two-dimensional system can analyze faster signals and thus provide higher frequency resolution. The operation of the proposed structure is demonstrated using array-factor theory.
137. Reliability of migration between habitat patches with heterogeneous ecological corridors

Rushdi, AMA (Rushdi, Ali Muhammad Ali); Hassan, AK (Hassan, Ahmad Kamal)

Abstract

Natural and designed ecological corridors are key elements for the survival of a species, as they allow the species to avoid local extinction by migrating to more suitable habitat patches. This paper studies various reliability metrics for the process of migration in a metapopulation landscape network from a critical habitat patch to destination habitat patches via perfect stepping stones and imperfect (deletable) corridors. The work presented herein generalizes earlier work on the application of reliability theory in ecology by allowing corridors to be heterogeneous (of non-identical unreliabilities). The paper is a tutorial exposition of modern reliability techniques, which formulate a problem in the Boolean domain, manipulate formulas to achieve disjointness of logically added subexpressions and retain statistical independence of logically multiplied ones, and finally reach a probability-ready expression that is directly transformed back to the probability domain. Several metrics are covered including system unreliability, life expectancy (MTTF), and component importance measures. An interesting finding is that the life expectancy of a classical landscape network is more than double that of a single corridor. Extensions to quantification of uncertainty in the above metrics and to evaluation of more sophisticated metrics of landscape connectivity are also pointed out. (C) 2015 Elsevier B.V. All rights reserved.
Abstract

This paper investigates the resource allocation problem for the Gaussian multiple access channel (MAC) with conferencing links, where the two transmitters can talk to each other via wired rate-limited channels. Moreover, the two transmitters are powered by a shared energy harvester which captures energy from the environment. We consider both the non-causal (the energy arrival levels at future time slots are known before transmissions) and the causal (only the energy arrival levels of past and present slots are known) energy-harvesting (EH) models. For the non-causal case, we formulate a resource allocation problem over a finite horizon of N time slots to characterize the boundary of the maximum departure region. We then develop the optimal offline power and rate allocation scheme by exploiting the hidden convexity of this problem. Interestingly, it is shown that there exists a maximum transmission rate (named the capping rate) for one of the transmitters. For the causal case, we examine the performance of the greedy scheme, in which the energy is depleted within each slot. In particular, we measure the utility of this scheme against the optimal offline one by competitive analysis, where the competitive ratio of the online greedy scheme, i.e., the maximum ratio between the profits obtained by the offline and online schemes over arbitrary energy arrival profiles, is derived.
139. Robust adaptive control of non-linear time-delay systems with saturation constraints

Pan, HH (Pan, Huihui); Sun, WC (Sun, Weichao); Gao, HJ (Gao, Huijun); Kaynak, O (Kaynak, Okyay); Alsaadi, F (Alsaadi, Fuad); Hayat, T (Hayat, Tasawar)

**Abstract**

In this study, a robust adaptive control strategy is presented for a class of uncertain time-delay non-linear systems in the presence of non-symmetric saturation constraints. On the one hand, an auxiliary system is constructed to reduce the negative effects caused by possible saturations, and the following stability proof ensures the theoretical strictness; the unknown time delays, on the other hand, are compensated by choosing appropriate Lyapunov-Krasovskii functions. Furthermore, the hyperbolic tangent functions are employed to efficiently avoid the controller singularity problem encountered in Lyapunov synthesis, and it is proved that the proposed controller design method is able to guarantee semi-global uniform ultimate boundedness of all the signals in the closed-loop system. Finally, an example simulation is conducted to verify the effectiveness of theoretical results.
140. Robust Granular Optimization: A Structured Approach for Optimization Under Integrated Uncertainty

Wang, SM (Wang, Shuming); Pedrycz, W (Pedrycz, Witold)

Abstract

Solving optimization problems under hybrid uncertainty bears a heavy computational burden. In this study, we propose a unified structured optimization approach, termed robust granular optimization (RGO), to tackle the optimization problems under hybrid manifold uncertainties in a computationally tractable manner. Essentially, the RGO can be regarded as a complementary fusion of granular computing and robust optimization techniques. The paradigm of RGO consists of three core phases: 1) uncertainty identification, 2) information granulation in which basic granular units (BGUs) are formed, and 3) robust optimization realized over the BGUs. Following the proposed paradigm, we develop two classes of RGO models for general single-stage and two-stage optimization problems with separable and higher order hybrid uncertainties, respectively. It is shown that both types RGO models can be equivalently transformed into linear programs or mixed integer linear programs that can be handled efficiently by off-the-shelf solvers. Furthermore, a target-based tradeoff model is developed to enhance the flexibility of the RGO models in balancing the granularity level (or robustness level) and the solution conservativeness. The tradeoff model can also be efficiently solved by a binary search algorithm. Finally, sufficient computational studies are presented, and comparisons with the existing approaches show that the RGO models can bring much higher computational efficiency and scalability without losing much optimality, and the RGO solutions exhibit a stronger resistance to the uncertainty.

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141. Scattering Similarities and Differences in Space and Time Discontinuous Media

Salem, MA (Salem, Mohamed A.); Caloz, C (Caloz, Christophe)

Abstract

Wave propagation in sub-cycle switched media is explored in connection with causality. The fast switching is modeled by abrupt change in the medium refractive index. The analysis reveals similarities and differences in wave behavior at spatial and temporal discontinuities. In both cases, a frequency shift (spatial and angular, respectively) takes place, while in a medium with temporal discontinuities multiple reflections do not occur due to causality.


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142. Scheduling and Analysis of Start-Up Transient Processes for Dual-Arm Cluster Tools With Wafer Revisiting
Pan, CR (Pan, Chun Rong); Qiao, Y (Qiao, Yan); Zhou, MC (Zhou, Meng Chu); Wu, NQ (Wu, Nai Qi)

Abstract

The trends of increasing wafer diameter and smaller lot sizes have led to more transient periods in wafer fabrication. For some wafer fabrication processes, such as atomic layer deposition, wafers need to visit some process modules for a number of times, instead of once, thus leading to a so-called revisiting process. Most previous studies on cluster tool scheduling focus on steady state at which cluster tools repeat identical cycles. Research on transient processes of dual-arm cluster tools with wafer revisiting processes becomes urgently needed for high-performance wafer fabrication. In order to speed up start-up transient processes, this paper adopts a program evaluation and review technique for the analysis of start-up transient processes and develops optimization algorithms for their scheduling of dual-arm cluster tools. Then, their complexity is analyzed. Finally, illustrative examples are given to show the applications of the proposed method.
143. Security-Constrained Co-Optimization Planning of Electricity and Natural Gas Transportation Infrastructures

Zhang, XP (Zhang, Xiaping); Shahidehpour, M (Shahidehpour, Mohammad); Alabdulwahab, AS (Alabdulwahab, Ahmed S.); Abusorrah, A (Abusorrah, Abdullah)

Abstract

This paper presents a co-optimization planning model that considers the long-term interdependency of natural gas and electricity infrastructures. The model incorporates the natural gas transportation planning objective in the co-optimization planning of power generation and transmission systems. The co-optimization planning model is decomposed into a least-cost master investment problem for natural gas and electricity systems which interacts with two operation subproblems representing the feasibility (security) and the optimality (economic) of the proposed co-optimization. In addition, the natural gas subproblem would check the feasibility of fuel supply transportation system as part of the proposed co-optimization planning. The co-optimization planning of electricity and natural gas infrastructures would satisfy the desired power system reliability criterion. The iterative process will continue between the co-optimization investment and the operation subproblems until an economic, secure, reliable, and fuel-supply feasible planning for the two interdependent infrastructures is obtained. Numerical simulations demonstrate the effectiveness of the proposed co-optimization planning approach.
Abstract

This paper investigates the role of integration of distributed storage with high penetration of variable renewable sources in power systems. The paper analyzes the impact of such integrations on the security, emission reduction, and the economic operation of electric power systems. The paper also identifies strategies for a larger penetration of variable generation resources without compromising the power system security. Mixed integer linear programing (MILP) is applied for the optimization of the day-ahead hourly security-constrained unit commitment. The assimilation of EVs (both as a provider and a utilizer of energy), renewable energy sources, and smart grid is regarded as a novel, low-cost, and low-emission solution to the existing challenges of electric power systems including the means of storing large quantities of energy considering variable renewable energy sources and large carbon footprints of conventional thermal units. Numerical studies are conducted in this paper to showcase the potential impacts of EV fleets as battery storage for peak load shaving, minimizing power grid operation costs and hourly wind curtailments, and optimizing the environmental impacts based on hourly commitment and dispatch of thermal generating units. (C) 2015 Elsevier Ltd. All rights reserved.
145. Semi-supervising Interval Type-2 Fuzzy C-Means clustering with spatial information for multi-spectral satellite image classification and change detection

Ngo, LT (Long Thanh Ngo); Mai, DS (Dinh Sinh Mai); Pedrycz, W (Pedrycz, Witold)

Abstract

Data clustering has been widely applied to numerous real-world problems such as natural resource management, urban planning, and satellite image analysis. Especially, fuzzy clustering with its ability of handling uncertainty has been developed for image segmentation or image analysis e.g. in health image analysis, satellite image classification. Normally, image segmentation algorithms like fuzzy clustering use spatial information along with the color information to improve the cluster quality. This paper introduces an approach, which exploits local spatial information between the pixel and its neighbors to compute the membership degree by using an interval type-2 fuzzy clustering algorithm, called IIT2-FCM. Besides, a Semi-supervising Interval Type-2 Fuzzy C-Means algorithm using spatial information, called SIIT2-FCM, is proposed to move the prototype of clusters to the expected centroids which are pre-defined on a basis of available samples. The proposed algorithms are applied to the problems of satellite image analysis consisting of land cover classification and change detection. Experimental results are reported for various datasets of the LandSat7 imagery at multi-temporal points and compared with the results produced by some existing algorithms and obtained from some survey data. The clustering results assessed with regard to some validity indexes demonstrate that the proposed algorithms form clusters of better quality and higher accuracy in problems of land cover classification and change detection. (C) 2015 Elsevier Ltd. All rights reserved.
146. Sentiment analysis: A review and comparative analysis of web services

Serrano-Guerrero, J (Serrano-Guerrero, Jesus); Olivas, JA (Olivas, Jose A.); Romero, FP (Romero, Francisco P.); Herrera-Viedma, E (Herrera-Viedma, Enrique)

Abstract

Sentiment Analysis (SA), also called Opinion Mining, is currently one of the most studied research fields. It aims to analyze people's sentiments, opinions, attitudes, emotions, etc., towards elements such as topics, products, individuals, organizations, and services. Different techniques and software tools are being developed to carry out Sentiment Analysis. The goal of this work is to review and compare some free access web services, analyzing their capabilities to classify and score different pieces of text with respect to the sentiments contained therein. For that purpose, three well-known collections have been used to perform several experiments whose results are shown and commented upon, leading to some interesting conclusions about the capabilities of each analyzed tool. (c) 2015 Elsevier Inc. All rights reserved.
Abstract

In this study, we address the regression problem on set-valued samples that appear in applications. To solve this problem, we propose a support vector regression approach for set-valued samples that generalizes the classical a-support vector regression. First, an initial representative point (or an element) for every set-valued sample is selected, and a weighted distance between the initial representative point and other points is determined. Second, based on the classification consistency principle, a search algorithm to determine the best representative point for every set-valued datum is designed. Thus, the set-valued samples are converted into numeric samples. Finally, a support vector regression that is based on set-valued data is constructed, and the regression results of the set-valued samples can be approximated using the method used for the numeric samples. Furthermore, the feasibility and efficiency of the proposed method is demonstrated using experiments with real-world examples concerning wind speed prediction and the prediction of peak particle velocity. (C) 2014 Published by Elsevier Ltd.
148. SICTQUAL: A fuzzy linguistic multi-criteria model to assess the quality of service in the ICT sector from the user perspective

Cid-Lopez, A (Cid-Lopez, Andries); Hornos, MJ (Hornos, Miguel J.); Carrasco, RA (Alberto Carrasco, Ramon); Herrera-Viedma, E (Herrera-Viedma, Enrique)

Abstract

The Information and Communication Technologies (ICTs) play an important role in the economic development, making it necessary to assess the quality of service perceived by consumers in this sector. The most effective quality assessment from the consumer perspective is still to be researched, yet the most common approach is oriented towards quantitative indicators. This study proposes to use a two-dimensional model that combines the widely accepted segmentation of ICTs with elements from the SERVQUAL quality model. This model, useful in multi-criteria decision-making situations, has been developed using the 2-tuple linguistic representation and fuzzy logic principles. This methodology prevents data loss during processing and provides relevant information through 16 indicators related to the quality of service. Besides, an expert-based mechanism is defined for the use of historical information extracted from completed surveys. As a practical case, this mechanism is applied to the historical information of a telecommunications company for assessing the quality of the service provided to its customers. (C) 2015 Elsevier B.V. All rights reserved.
Simultaneous effects of Hall and convective conditions on peristaltic flow of couple-stress fluid in an inclined asymmetric channel

Hayat, T (Hayat, T.); Iqbal, M (Iqbal, Maryam); Yasmin, H (Yasmin, Humaira); Alsaadi, FE (Alsaadi, Fuad E.); Gao, HJ (Gao, Huijun)

Abstract

A mathematical model is developed to analyse the peristaltic flow of couple-stress fluid in an inclined asymmetric channel with convective conditions. Soret and Dufour and Hall effects are taken into account. Analysis has been carried out in a wave frame of reference. Expressions for velocity, pressure gradient, temperature and concentration are constructed. Pumping and trapping phenomena are examined. Impact of sundry parameters on the velocity, temperature and concentration is discussed.
150. Simultaneous effects of Hall current and thermal deposition in peristaltic transport of Eyring-Powell fluid

Hayat, T (Hayat, T.); Tanveer, A (Tanveer, Anum); Yasmin, H (Yasmin, Humaira); Alsaadi, F (Alsaadi, Fuad)

Abstract

Peristaltic flow by a sinusoidal traveling wave in the walls of two-dimensional channel with wall properties is investigated. The channel is filled with incompressible Eyring-Powell fluid. Mathematical modeling is developed through aspects of Hall current, thermal deposition and convection. Long wavelength and low Reynolds number considerations are adopted. Perturbation solutions to the resulting problem for small material parameter of fluid are obtained. Expressions of velocity, temperature, concentration and stream function are derived. Variations of pertinent parameters on the physical quantities of interest are explored in detail. The present analysis is especially important to predict the rheological characteristics in engineering applications by peristalsis.
Simultaneous effects of radial magnetic field and wall properties on peristaltic flow of Carreau-Yasuda fluid in curved flow configuration

Hayat, T (Hayat, T.); Tanveer, A (Tanveer, A.); Alsaadi, F (Alsaadi, F.)

Abstract

The objective of present article is to address the magnetohydrodynamic (MHD) peristaltic flow of Carreau-Yasuda fluid in a curved geometry. The channel boundaries satisfy wall slip and compliant properties. The fluid is electrically conducting through an applied magnetic field in the radial direction. Heat transfer is also studied. Governing equation comprised the viscous dissipation effects. The nonlinear expressions are first obtained and then approximated using long wavelength and low Reynolds number considerations. The resulting systems are solved for the series solutions. The expressions of velocity, temperature, heat transfer coefficient and stream function are obtained and analyzed via graphical illustrations. (C) 2015 Author(s). All article content, except where otherwise noted, is licensed under a Creative Commons Attribution 3.0 Unported License.
152. Solving Unit Commitment Problem Using Multi-agent Evolutionary Programming Incorporating Priority List

Othman, MNC (Othman, M. N. C.); Rahman, TKA (Rahman, T. K. A.); Mokhlis, H (Mokhlis, H.); Aman, MM (Aman, M. M.)

Abstract

This paper presents an approach to solve the unit commitment problem using a newly developed Multi-agent Evolutionary Programming incorporating Priority List optimisation technique (MAEP-PL). The objective of this study is to search for generation scheduling such that the total operating cost can be minimised when subjected to a variety of constraints, while at the same time reducing its computational time. The proposed technique assimilates the concepts of Priority Listing (PL), Multi-agent System (MAS) and Evolutionary Programming (EP) as its basis. In the proposed technique, deterministic PL technique is applied to produce a population of initial solutions. The search process is refined using heuristic EP-based algorithm with multi-agent approach to produce the final solution. The developed technique is tested on ten generating units test system for a 24-h scheduling period, and the results are compared with the standard Evolutionary Programming (EP), Evolutionary Programming with Priority Listing (EP-PL) and Multi-agent Evolutionary Programming (MAEP) optimisation techniques. From the obtained results and the comparative studies, it was found that the proposed MAEP-PL optimisation technique is able to solve the unit commitment problem where the total daily generation cost is effectively minimised and the computation time is reduced as compared to other techniques.

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Publisher: SPRINGER HEIDELBERG
Web of Science Categories: Multidisciplinary Sciences
Research Areas: Science & Technology - Other Topics
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 4780
Soret and Dufour effects in three-dimensional flow over an exponentially stretching surface with porous medium, chemical reaction and heat source/sink

Hayat, T (Hayat, Tasawar); Muhammad, T (Muhammad, Taseer); Shehzad, SA (Shehzad, Sabir Ali); Alsaedi, A (Alsaedi, A.)

Abstract

Purpose - The purpose of this paper is to study the Soret and Dufour effects in three-dimensional flow induced by an exponential stretching surface in a porous medium. Design/methodology/approach - Series solutions are developed. Findings - The authors observed that the temperature profile and thermal boundary layer thickness are enhanced when the authors increase the values of Dufour number. It is also examined that the concentration field and its associated boundary layer thickness are higher for the larger values of Soret number. Originality/value - Such investigation is not available in the literature.

Sources

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29

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Article

Shehzad, SA (reprint author), Quaid I Azam Univ, Dept Math, Islamabad, Pakistan.

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Thermodynamics; Mathematics; Mechanics

Faculty of Engineering

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154. Space-Time Modulated Nonreciprocal Mixing, Amplifying and Scanning Leaky-Wave Antenna System

Taravati, S (Taravati, Sajjad); Caloz, C (Caloz, Christophe)

Abstract

A space-time modulated leaky-wave antenna system simultaneously performing mixing (up/down frequency conversion), amplification and beam scanning is presented and demonstrated by full-wave simulations. This system is expected to pave the way for a diversity of novel radiative systems exploiting exotic space-time transitions in the dispersion diagram.

Sources:
- Year: 2015
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- Language: English
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- Reprint Address: Taravati, S (reprint author), Polytech Montreal, Dept Elect Engn, Montreal, PQ H2T 1J3, Canada.
- Publisher: IEEE
- Faculty Name: Faculty of Engineering
- Department Name: Electrical and Computer Engineering
- DSR No.: 7484
Abstract

Quaternary deposit landslides are a representative type of geological disasters in the Three Gorges area. Landslide medium-long-term forecast results offer an important and effective measure to prevent landslide disasters and help guarantee operation security of the reservoir. We applied data mining methods into landslide spatio-temporal data analysis to discover the cause mechanisms, triggered factors and deformation laws, as well as provided medium-long-term forecast criteria for Quaternary deposit landslides in Zigui County in the Three Gorges. We showed that data mining methods used in this study offer an interesting and useful vehicle supporting analysis of a huge amount of landslide spatio-temporal data. The established forecast model exhibits high accuracy, while the discovered forecast criteria come with high confidence and representation capabilities.
156. Speaker identification using vowels features through a combined method of formants, wavelets, and neural network classifiers

Daqrouq, K (Daqrouq, Khaled); Tutunji, TA (Tutunji, Tarek A.)

Abstract

This paper proposes a new method for speaker feature extraction based on Formants, Wavelet Entropy and Neural Networks denoted as FWENN. In the first stage, five formants and seven Shannon entropy wavelet packet are extracted from the speakers’ signals as the speaker feature vector. In the second stage, these 12 feature extraction coefficients are used as inputs to feed-forward neural networks. Probabilistic neural network is also proposed for comparison. In contrast to conventional speaker recognition methods that extract features from sentences (or words), the proposed method extracts the features from vowels. Advantages of using vowels include the ability to recognize speakers when only partially-recorded words are available. This may be useful for deaf-mute persons or when the recordings are damaged. Experimental results show that the proposed method succeeds in the speaker verification and identification tasks with high classification rate. This is accomplished with minimum amount of information, using only 12 coefficient features (i.e. vector length) and only one vowel signal, which is the major contribution of this work. The results are further compared to well-known classical algorithms for speaker recognition and are found to be superior. (C) 2014 Elsevier B.V. All rights reserved.
Abstract

This paper describes a variable structure control for fractional-order systems with delay in both the input and state variables. The proposed method includes a fractional-order state predictor to eliminate the input delay. The resulting state-delay system is controlled through a sliding mode approach where the controller uses a sliding surface defined by fractional order integral. Then, the proposed control law ensures that the state trajectories reach the sliding surface in finite time. Based on recent results of Lyapunov stability theory for fractional-order systems, the stability of the closed loop is studied. Finally, an illustrative example is given to show the interest of the proposed approach.
Abstract

Cloud computing is a promising paradigm capable of rationalizing the use of computational resources by means of outsourcing and virtualization. Virtualization allows to instantiate virtual machines (VMs) on top of fewer physical systems managed by a VM manager. Performance evaluation of clouds is required to evaluate and quantify the cost-benefit of a strategy portfolio and the quality of service (QoS) experienced by end-users. Such evaluation is not feasible by means of simulation or on-the-field measurement, due to the great scale of parameter spaces that have to be traversed. In this study, we present a stochastic-queuing-network-based approach to performance analysis of migration-enabled clouds in error-prone environment. Several performance metrics are defined and evaluated: utilization, expected task completion time, and task rejection rate under different load conditions and error intensities. To validate the proposed approach, we obtain experimental performance data through a real-world cloud and conduct a confidence-interval analysis. The analysis results suggest the perfect coverage of theoretical performance results by corresponding experimental confidence intervals.

Sources

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Publisher: IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC
Web of Science Categories: Automation & Control Systems; Computer Science, Interdisciplinary Applications; Engineering, Industrial
Research Areas: Automation & Control Systems; Computer Science; Engineering
Faculty Name: Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No.: 6633
Abstract

This paper proposes a twice rapid transfer alignment algorithm based on dual models in order to solve the problems such as long convergence time, poor accuracy, and heavy computation burden resulting from the traditional nonlinear error models. The quaternion matching method based on quaternion error model along with the extended Kalman filter (EKF) is applied to deal with the large misalignment in the first phase. Then in the second transfer alignment phase, velocity plus attitude matching method as well as classical Kalman filter is adopted. The simulation and the results of vehicle tests demonstrate that this method combines the advantages of both nonlinear and linear error models with the guarantee of accuracy and fastness.
160. Temperature-Dependent Impedance Characteristics of Temperature-Stable High-Speed 980-nm VCSELs

Li, H (Li, Hui); Lott, JA (Lott, James A.); Wolf, P (Wolf, Philip); Moser, P (Moser, Philip); Larisch, G (Larisch, Gunter); Bimberg, D (Bimberg, Dieter)

Abstract

The temperature dependence of the impedance characteristics of high bit rate, highly temperature-stable 980-nm oxide-aperture vertical-cavity surface-emitting lasers (VCSELs) is investigated. A small-signal equivalent circuit model is fitted to measured small-signal reflection S11 and S21 scattering parameters across a large range of operating bias currents, temperatures, and oxide-aperture diameters to extract the circuit elements, -3 dB modulation bandwidth, relaxation resonance frequency, and parasitic cutoff frequency for each particular operating condition. The parasitic cutoff frequency of our small oxide-aperture diameter VCSELs is highly temperature insensitive from room temperature up to 85 degrees C, and does not limit our VCSELs' maximum data transmission rate. Finally, the dependence of the impedance characteristics and modulation bandwidth of our VCSELs on the oxide-aperture diameter is analyzed at 25 degrees C and 85 degrees C. The larger capacitance is the main reason of our larger aperture VCSELs, compared with smaller aperture VCSELs, have a lower parasitic cutoff frequency.
161. The BioMart community portal: an innovative alternative to large, centralized data repositories

Smedley, D (Smedley, Damian); Haider, S (Haider, Syed); Durinck, S (Durinck, Steffen); Pandini, L (Pandini, Luca); Provero, P (Provero, Paolo); Allen, J (Allen, James); Arnaiz, O (Arnaiz, Olivier); Awedh, MH (Awedh, Mohammad Hamza); Baldock, R (Baldock, R)

Abstract

The BioMart Community Portal (www.biomart.org) is a community-driven effort to provide a unified interface to biomedical databases that are distributed worldwide. The portal provides access to numerous database projects supported by 30 scientific organizations. It includes over 800 different biological datasets spanning genomics, proteomics, model organisms, cancer data, ontology information and more. All resources available through the portal are independently administered and funded by their host organizations. The BioMart data federation technology provides a unified interface to all the available data. The latest version of the portal comes with many new databases that have been created by our ever-growing community. It also comes with better support and extensibility for data analysis and visualization tools. A new addition to our toolbox, the enrichment analysis tool is now accessible through graphical and web service interface. The BioMart community portal averages over one million requests per day. Building on this level of service and the wealth of information that has become available, the BioMart Community Portal has introduced a new, more scalable and cheaper alternative to the large data stores maintained by specialized organizations.

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Publisher : OXFORD UNIV PRESS
Web of Science Categories : Biochemistry & Molecular Biology
Research Areas : Biochemistry & Molecular Biology
Faculty Name : Faculty of Engineering
Department Name: Electrical and Computer Engineering
DSR No. : 5816
162. The co-learning in the design, simulation and optimization of a solar concentrating system

Alhalabi, W (Alhalabi, Wadde); Reif, J (Reif, John); Elsheikh, Z (Elsheikh, Zeineb); Felimban, H (Felimban, Heba); Fallata, M (Fallata, Majda); Thabit, K (Thabit, Khalid); Abusorrah, A (Abusorrah, Abdullah)

Abstract

Due to the significant environmental and economic impact of the solar energy on our life, many solar concentrator systems (SCSs) exist today, the majority of them being very costly to construct. In this paper, an efficient low-cost SCS based on Reif research was implemented using principles of collaboration and co-learning. This system basically converts the solar-thermal energy to other forms of usable energy such as electrical energy. It mainly consists of three parts: (i) the primary concentrators (PCs), which collect the solar radiations coming from the sun and reflect it upward to the secondary concentrator; (ii) the secondary concentrators (SCs) which are moving concentrators suspended on cables above the solar collecting field; and (iii) the receiving energy collector (REC). The final results showed that the proposed system functions in the expected limits. (C) 2014 Elsevier Ltd. All rights reserved.
The consensus models with interval preference opinions and their economic interpretation

Gong, ZW (Gong, Zaiwu); Xu, XX (Xu, Xiaoxia); Zhang, HH (Zhang, Huanhuan); Ozturk, UA (Ozturk, U. Aytun); Herrera-Viedma, E (Herrera-Viedma, Enrique); Xu, C (Xu, Chao)

Abstract

This paper aims to explore the case when an individual opinion is interval preference in consensus decision making. And for this purpose, we construct two multi-objective optimization models: one based on the minimum cost from the perspective of the moderator, the other the maximum return from the perspective of the individuals. On the basis of multi-objective programming theories, these multi-objective programming models are then transformed into two single-objective linear programming models, i.e., the primal model and the dual model. The primal model focuses on how to obtain a consensus with the minimum cost, while the dual model is concerned with how to get the maximum return. With the help of dual linear programming theories, we have revealed the following economic significance of the primal-dual consensus models: the primal-dual consensus models can not only help us probe into the relations between the minimum cost paid by the moderator and the maximum return expected by individuals who changed their opinions before, but also help us explore the relations between the unit cost that the moderator pays each individual, unit return that each individual receives, each individual opinion and the consensus opinion. This paper with the aid of theoretical analysis and an illustrative example indicates that once the consensus is obtained, the optimal unit return and optimal consensus opinion value are also solved. This paper also points out that the amount of the total return acquired by all the individuals who have abandoned their original opinions before is equivalent to that of the total cost paid by the moderator to reach the consensus. This paper also argues that there exists compact correlations between the individual's unit return, the consensus opinion, the individual's interval opinion, and the moderator's unit cost. (C) 2015 Elsevier Ltd. All rights reserved.
Department Name: Electrical and Computer Engineering
DSR No.: 5452
164. The q-Least Mean Squares algorithm

Al-Saggaf, UM (Al-Saggaf, Ubaid M.); Moinuddin, M (Moinuddin, Muhammad); Arif, M (Arif, Muhammad); Zerguine, A (Zerguine, Azzedine)

**Abstract**

The Least Mean Square (LMS) algorithm inherits slow convergence due to its dependency on the eigenvalue spread of the input correlation matrix. In this work, we resolve this problem by developing a novel variant of the LMS algorithms based on the q-derivative concept. The q-gradient is an extension of the classical gradient vector based on the concept of Jackson's derivative. Here, we propose to minimize the LMS cost function by employing the concept of q-derivative instead of the conventional derivative. Thanks to the fact that the q-derivative takes larger steps in the search direction as it evaluates the secant of the cost function rather than the tangent (as in the case of a conventional derivative), we show that the q-derivative gives faster convergence for q > 1 when compared to the conventional derivative. Then, we present a thorough investigation of the convergence behavior of the proposed q-LMS algorithm and carry out different analyses to assess its performance. Consequently, new explicit closed-form expressions for the mean-square-error (MSE) behavior are derived. Simulation results are presented to corroborate our theoretical findings. (C) 2014 Elsevier B.V. All rights reserved.
Thermal Generation Flexibility With Ramping Costs and Hourly Demand Response in Stochastic Security-Constrained Scheduling of Variable Energy Sources

Wu, HY (Wu, Hongyu); Shahidehpour, M (Shahidehpour, Mohammad); Alabdulwahab, A (Alabdulwahab, Ahmed); Abusorrah, A (Abusorrah, Abdullah)

Abstract

This paper proposes a stochastic day-ahead scheduling of electric power systems with flexible resources for managing the variability of renewable energy sources (RES). The flexible resources include thermal units with up/down ramping capability, energy storage, and hourly demand response (DR). The Monte Carlo simulation (MCS) is used in this paper for simulating random outages of generation units and transmission lines as well as representing hourly forecast errors of loads and RES. Numerical tests are conducted for a 6-bus system and a modified IEEE 118-bus system and the results demonstrate the benefits of applying demand response as a viable option for managing the RES variability in the least-cost stochastic power system operations.
166. Thermally stratified stagnation point flow of Casson fluid with slip conditions

Hayat, T (Hayat, Tasawar); Farooq, M (Farooq, Muhammad); Alsaedi, A (Alsaedi, A.)

Abstract

Purpose - The purpose of this paper is to focus on the stratified phenomenon through vertical stretching cylinder in the region of stagnation point with slip effects. Design/methodology/approach - Homotopy analysis method is used to find the series solutions of the governing equations. Findings - Velocity profile decreases with an increase in stratified parameters due to temperature and concentration. Velocity and thermal slips cause a reduction in the velocity profile. Thermally stratified and thermal slip parameters reduce the temperature field. Originality/value - The present analysis has not been existed in the literature yet.

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Research Areas : Thermodynamics; Mathematics; Mechanics
Faculty Name : Faculty of Engineering
Department Name: : Electrical and Computer Engineering
DSR No. : 7955
167. Three-way decisions based on decision-theoretic rough sets under linguistic assessment with the aid of group decision making

Liang, DC (Liang, Decui); Pedrycz, W (Pedrycz, Witold); Liu, D (Liu, Dun); Hu, P (Hu, Pei)

Abstract

Based on decision-theoretic rough set model of three-way decisions, we augment the existing model by introducing linguistic terms. Considering the two types of parameters being used in the three-way decisions with linguistic assessment, a certain type of novel three-way decisions based on the Bayesian decision procedure is constructed. In this way, three-way decisions with decision-theoretic rough sets are extended to the qualitative environment. With the aid of multi-attribute group decision making, the values of these parameters are determined. An adaptive algorithm supporting consistency improvement of multi-attribute group decision making is designed. Then, we optimize the scales of the linguistic terms with the use of particle swarm optimization. The values of these parameters of three-way decisions are aggregated when proceeding with group decision making. Finally, the proposed model of three-way decisions with linguistic assessment is applied to the selection process of new product ideas. (C) 2015 Elsevier B.V. All rights reserved.
Towards hybrid clustering approach to data classification: Multiple kernels based interval-valued Fuzzy C-Means algorithms

Nguyen, DD (Dzung Dinh Nguyen); Ngo, LT (Long Thanh Ngo); Pham, LT (Long The Pham); Pedrycz, W (Pedrycz, Witold)

Abstract

In this study, kernel interval-valued Fuzzy C-Means clustering (KIFCM) and multiple kernel interval-valued Fuzzy C-Means clustering (MKIFCM) are proposed. The KIFCM algorithm is built on a basis of the kernel learning method and the interval-valued fuzzy sets with intent to overcome some drawbacks existing in the "conventional" Fuzzy C-Means (FCM) algorithm. The development of the method is motivated by two factors. First, uncertainty is inherent in clustering problems due to some information deficiency, which might be incomplete, imprecise, fragmentary, not fully reliable, vague, contradictory, etc. With this regard, interval-valued fuzzy sets exhibit advantages when handling such aspects of uncertainty. Second, kernel methods form a new class of pattern analysis algorithms which can cope with general types of data and detect general types of relations (geometric properties) by embedding input data in a vector space based on the inner products and looking for linear relations in the space. However, as the clustering problems may involve various input features exhibiting different impacts on the obtained results, we introduce a new MKIFCM algorithm, which uses a combination of different kernels (giving rise to a concept of a composite kernel). The composite kernel was built by mapping each input feature onto individual kernel space and linearly combining these kernels with the optimized weights of the corresponding kernel. The experiments were completed for several well-known datasets, land cover classification from multi-spectral satellite image and Multiplex Fluorescent In Situ Hybridization (MFISH) classification problem. The obtained results demonstrate the advantages of the proposed algorithms. (C) 2015 Elsevier B.V. All rights reserved.
169. Using interval information granules to improve forecasting in fuzzy time series

Lu, W (Lu, Wei); Chen, XY (Chen, Xueyan); Pedrycz, W (Pedrycz, Witold); Liu, XD (Liu, Xiaodong); Yang, JH (Yang, Jianhua)

Abstract

In the process of modeling and forecasting of fuzzy time series, an issue on how to partition the universe of discourse impacts the quality of the forecasting performance of the constructed fuzzy time series model. In this paper, a novel method of partitioning the universe of discourse of time series based on interval information granules is proposed for improving forecasting accuracy of model. In the method, the universe of discourse of time series is first pre-divided into some intervals according to the predefined number of intervals to be partitioned, and then information granules are constructed in the amplitude-change space on the basis of data of time series belonging to each of intervals and their corresponding change (trends). In the sequel, optimal intervals are formed by continually adjusting width of these intervals to make information granules which associate with the corresponding intervals become most "informative". Three benchmark time series are used to perform experiments to validate the feasibility and effectiveness of proposed method. The experimental results clearly show that the proposed method produces more reasonable intervals exhibiting sound semantics. When using the proposed partitioning method to determine intervals for modeling of fuzzy time series, forecasting accuracy of the constructed model are prominently enhanced. (C) 2014 Elsevier Inc. All rights reserved.
Versatile Phasers Constituted of Coupling-Free Nonuniform Stub-Loaded Transmission Lines

Taravati, S (Taravati, Sajjad); Caloz, C (Caloz, Christophe)

Abstract

A nonuniform stub-loaded and coupling-free broadband phaser is proposed as an alternative to conventional coupled-line sections based phasers for enhanced design flexibility, reduced complexity and lower cost in Radio Analog Signal Processing (R-ASP) systems. Nonuniform open- and short-terminated stub-loaded sections are employed to achieve specified highly flexible group delays with flat transmission magnitude responses. The phaser does not require multilayer or wire-bonding technologies since it consists of coupling-free transmission lines. The principle and synthesis procedure of the phaser are presented and two design examples with diverse specifications are presented with theory and full-wave simulation results. The phaser can be realized using microstrip technology and integrate with different lumped components and planar structures.
We study the transformation of X waves under time discontinuities. We find out that the wave splits into two X waves, that the spatial features are conserved, and that the time features are altered, the wave being either compressed or expanded depending on the indices of refraction before and after the discontinuity. We also find that one of the transformed waves is time-reversed. We expect this work will provide solutions in applications such as plasma science and metamaterials.
1. A Nonlinear Goal Programming Model for University Admission Capacity Planning with Modified Differential Evolution Algorithm

El-Quiliti, SA (El-Quiliti, Said Ali); Ragab, AHM (Ragab, Abdul Hamid Mohamed); Abdelaal, R (Abdelaal, Reda); Mohamed, AW (Mohamed, Ali Wagdy); Mashat, AS (Mashat, Abdulfattah Suliman); Noaman, AY (Noaman, Amin Yousef); Altalhi, AH (Altalhi, Abdulrahman Helal)

Abstract

This paper proposes a nonlinear Goal Programming Model (GPM) for solving the problem of admission capacity planning in academic universities. Many factors of university admission capacity planning have been taken into consideration among which are number of admitted students in the past years, total population in the country, number of graduates from secondary schools, desired ratios of specific specialties, faculty-to-students ratio, and the past number of graduates. The proposed model is general and has been tested at King Abdulaziz University (KAU) in the Kingdom of Saudi Arabia, where the work aims to achieve the key objectives of a five-year development plan in addition to a 25-year future plan (AAFAQ) for universities education in the Kingdom. Based on the results of this test, the proposed GPM with a modified differential evolution algorithm has approved an ability to solve general admission capacity planning problem in terms of high quality, rapid convergence speed, efficiency, and robustness.
2. A sustainability comparison between conventional and high-speed machining

Al-Ghamdi, KA (Al-Ghamdi, Khalid A.); Iqbal, A (Iqbal, Asif)

Abstract

In the 1990s, the industrial application of high-speed machining achieved enormous success because of its favorable characteristics such as high productivity, better work quality, and ease of machining thin-walled structures. With fast changing emphasis of the world's manufacturing sector towards environmental benignity, the issue of sustainability with regard to application of high-speed machining becomes pivotal. The article presents an experimental investigation regarding comparison of conventional machining and high-speed machining with respect to sustainability measures. A set of 64 grooving experiments was performed on two tempers each of a high-strength low-alloy steel and a heat treatable titanium alloy. The experimental design focused on studying the effects of cutting mode (conventional/high-speed machining), cutting speed levels for each of the two modes, feed rate, and minimum quantity lubrication on tool life, specific cutting energy, productivity, process cost, and machining forces. It was found that the choice between the two machining modes is highly sensitive with respect to manufacturing sustainability. The conventional machining mode was found to be comparatively economical, while the high-speed machining mode significantly outperformed the other in terms of low specific energy consumption and high productivity. The article asserts that high speed machining can completely surpass conventional machining as the sustainable way of metal cutting if the ways could be found to curb excessive tool damage observable at high cutting speeds. (C) 2015 Elsevier Ltd. All rights reserved.
3. API Gravity, Sulfur Content, and Desulfurization of Crude Oil

Demirbas, A (Demirbas, A.); Alidrisi, H (Alidrisi, H.); Balubaid, MA (Balubaid, M. A.)

Abstract

In this review, strategies for crude oil desulfurization are evaluated by reviewing desulfurization literature. The most important characteristics of crude oil that affect the market price are its sulfur content and gravity. Low sulfur content of crude oil is particularly preferred. Petroleum includes crude oil, natural gas, and heavy oil. Petroleum refineries convert crude oils and other input streams into dozens of refined (co)products. Two properties are especially useful for quickly classifying and comparing crude oils: API gravity (a measure of density) and sulfur content. Sulfur is naturally present as an impurity in fossil fuels. The removal of organosulfur compounds from crude oil is an important aspect of all countries to reduce air pollution. The sulfur compounds from gasoline are generally removed by treatment with an alkaline solution sodium plumbite. At large scales, the most economical technology for converting hydrogen sulfide into sulfur is the Claus process. This well-established process uses partial combustion and catalytic oxidation to convert about 97% of the H2S to elemental sulfur.

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Research Areas: Energy & Fuels; Engineering
Faculty Name: Faculty of Engineering
Department Name: Industrial Engineering
DSR No.: 8339
Abstract

Bioconversion of H2S into elemental sulfur has been investigated using an airlift bioreactor with direct injection of the gas into the bioreactor. Almost complete removal of H2S has been achieved at its inlet concentrations lower than 25 000 ppm. Maximum bioconversion capacity of ca 111.3 g/(m$^3$.h) and up to 93.5% conversion of the inlet sulfide to elemental sulfur was obtained. To further improve the bioreactor performance, factors influencing mass transfer and biological activity should be investigated in future studies.

Taylan, O (Taylan, Osman); Kabli, MR (Kabli, Mohammed R.); Saeedpoor, M (Saeedpoor, Mahdi); Vafadarnikjoo, A (Vafadarnikjoo, Amin)

Abstract

Taylan et al. [2014]. Construction projects selection and risk assessment by Fuzzy AHP and Fuzzy TOPSIS methodologies' [Applied Soft Computing 17, 105-116] aimed at using novel analytic tools to assess the construction projects and their total risks under inexact and imprecise situations. They applied Fuzzy Analytic Hierarchy Process (Fuzzy AHP) to create appropriate weights for five main criteria i.e. time, cost, quality, safety, and environmental sustainability and then Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (Fuzzy TOPSIS) to rank the 30 construction projects on the basis of the opinions of seven decision makers in various sectors in Saudi Arabia. In this work, some inaccuracies of this recently published article are shown and corrected. (C) 2015 Elsevier B.V. All rights reserved.
Development and characterization of Sn-1.3Ag-0.7Cu solder bearing Zn for electronic packaging

El-Daly, AA (El-Daly, A. A.); Radwan, N (Radwan, N.); El-Eizz, HMA (El-Eizz, H. M. Abo); Hamza, BA (Hamza, B. A.)

Abstract

The effect of small amounts of Zn on microstructure, thermal behavior and mechanical properties of low silver-content Sn-1.3Ag-0.7Cu (SAC137) solder was investigated. Microstructural investigations of SAC137 solder revealed that both the intermetallic compounds of rod-like Cu6Sn5 and needle-like Ag3Sn particles are dispersed in beta-Sn matrix, which are gradually diminished with increasing Zn content in plain solder. Moreover, addition of 0.75 wt% Zn promotes the nucleation of beta-Sn grains and leads to formation of new (Cu,Ag)(5)Zn-8 IMC particles. Although the strength and Young's modulus of plain solder are increased with increasing Zn content, the elongation was firstly increased with 0.75 wt% Zn addition and then decreased after adding 1.5 % Zn. The higher mechanical strength was contributed by the fine beta-Sn grains and precipitations strengthen effects of new (Cu,Ag)(5)Zn-8 IMC particles. The presence of Zn in SAC137-0.75 wt% Zn solder seems to result in a complete reduction of brittle proeutectic Ag3Sn phase to maintain the ductility at the highest level. The new (Cu,Ag)(5)Zn-8 IMC developed in Zn added specimens was found to envially affect the thermal properties according to DSC analyses.

Sources: JOURNAL OF MATERIALS SCIENCE-MATERIALS IN ELECTRONICS
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Reprint Address: El-Daly, AA (reprint author), Zagazig Univ, Fac Sci, Dept Phys, Zagazig, Egypt.
Publisher: SPRINGER
Web of Science Categories: Engineering, Electrical & Electronic; Materials Science, Multidisciplinary; Physics, Applied; Physics, Condensed Matter
Research Areas: Engineering; Materials Science; Physics
Faculty Name: Faculty of Engineering
Department Name: Industrial Engineering
DSR No.: 4803
7. Development of a Study Plan for Industrial Engineering Program Using Interpretive Structural Modeling Technique

Alidrisi, H (Alidrisi, Hisham)

Abstract

Because the number of educational institutions all over the world is increasing, the competition to achieve excellence in academic quality has become a prerequisite for sustainability and continuous improvement. Certification from reputed international accreditation boards provides means for such institutions to achieve excellence through the complex accreditation processes. The Accreditation Board for Engineering and Technology (ABET) is one of the prestigious international academic accreditation bodies. Out of all the significant ABET criteria for certification, Students Outcomes (SOs) represent the heart of the accreditation process as they cover a wide range of skills and capabilities expected by the industries and labor markets. The aim of this paper is to provide a methodological approach to prioritize SOs using the Interpretive Structural Modeling (ISM) to construct a meticulous study plan. A case study on the Department of Industrial Engineering at King Abdulaziz University (KAU) is presented to illustrate the proposed approach. The results indicated that SOs can be systematically linked with the curriculum in order to build up a study plan in a systematic manner. The results also revealed that students should be trained to be able to work in teams at the beginning of the study plan. Alternatively, SOs like, 'ability to design and interpret experiments', 'understand the impact of engineering solutions', and 'engage in lifelong learning' etc. were proposed to be imparted within the final year of the study plan, in the subsequent phases.

Sources

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Reprint Address: Alidrisi, H (reprint author), King Abdulaziz Univ, Dept Ind Engn, POB 80204, Jeddah 21589, Saudi Arabia.
Publisher: TEMPUS PUBLICATIONS
Web of Science Categories: Education, Scientific Disciplines; Engineering, Multidisciplinary
Research Areas: Education & Educational Research; Engineering
Faculty Name: Faculty of Engineering
Department Name: Industrial Engineering
DSR No.: 7786
8. Diesel Fuel From Waste Lubricating Oil by Pyrolitic Distillation

Demirbas, A (Demirbas, A.); Baluabaid, MA (Baluabaid, M. A.); Kabli, M (Kabli, M.); Ahmad, W (Ahmad, W.)

Abstract

Recycling and rerefining are the applicable processes for upgrading of petroleum-based wastes by converting them into reusable products such as gasoline, diesel fuel, and heavy oil. Possible acceptable processes are cracking and pyrolysis. The aim of the study was to obtain diesel fuel from waste lubricating oil by pyrolitic distillation method, which can be used in diesel engines. If the purpose were to maximize the yield of distillate products resulting from crude oil pyrolysis, a low temperature, high heating rate, and short gas residence time process would be required. The effect of sodium carbonate (Na2CO3) as an additive on density, viscosity, flash point, sulfur content, higher heating value, and pyrolytic distillation yields was investigated. The purified oil samples are blended separately with additives having mass basis of 2%, 6%, and 10%. The mixed samples were exposed to pyrolytic distillation process to produce fuels to be used in engines.
9. Evaluation of beech for production of bio-char, bio-oil and gaseous materials

Aburas, H (Aburas, Hani); Demirbas, A (Demirbas, Ayhan)

Abstract

Evaluation of Oriental beech (Fagus orientalis L.) was investigated with aspect of thermochemical conversion to obtain bio-char, bio-oil and gaseous. When the pyrolysis temperature increased, the bio-char yield decreased. A high temperature and smaller particles increase the heating rate resulting in a decreased bio-char yield. The bio-char obtained are carbon rich, with high heating value and relatively pollution-free potential solid biofuel. The liquefaction yield sharply increased with increasing the temperature near critical temperature and after that. In the pyrolysis, increases of liquid yields are considerably sharply for all of the samples with increasing of pyrolysis temperature from 690K to 720K. The beechnut oil was converted to biodiesel in supercritical methanol without using the catalyst. Experiments have been carried out in an autoclave at 493, 523 and 593K, and with molar ratios of 1:6-1:40 of the oil to methanol. The yield of alkyl ester increased with increasing the molar ratio of oil to alcohol. (C) 2014 The Institution of Chemical Engineers. Published by Elsevier B.V. All rights reserved.
Evaluation of Eremurus spectabilis for production of bio-oils with supercritical solvents

Aysu, T (Aysu, Tevfik); Demirbas, A (Demirbas, Ayhan); Bengu, AS (Bengu, Aydin Sukru); Kucuk, MM (Kucuk, Mehmet Masuk)

Abstract

Eremurus spectabilis samples were liquefied in organic solvents (methanol, ethanol and acetone) with (sodium hydroxide and ferric chloride) and without catalyst in a cylindrical reactor at temperatures of 270, 290 and 310 degrees C under supercritical conditions. The effects of liquefaction parameters such as temperature, catalyst and solvent on product yields were investigated. The liquid products were extracted with diethyl ether and benzene using an extraction procedure. The product yields in supercritical methanol, ethanol and acetone were found to as 41.6%, 53.8% and 64.3% in the non-catalytic runs at 310 degrees C, respectively. The highest conversion was obtained in supercritical acetone in the presence of ferric chloride (10%) at same temperature in the catalytic runs. The produced liquids in acetone were analyzed and characterized by elemental, Fourier transform infrared spectroscopy (FT-IR), gas chromatography-mass spectrometry (GC-MS). The liquid products (bio-oils) obtained with acetone contained various types of components including aromatics, nitrogenated and oxygenated compounds. As the bio-oils obtained exhibit high heat values, E. spectabilis is presented as a potential feedstock candidate for production of bio-fuels or valuable chemicals. (C) 2014 The Institution of Chemical Engineers. Published by Elsevier B.V. All rights reserved.
11. Inverse Approach to the Graph Model for Conflict Resolution

Kinsara, RA (Kinsara, Rami A.); Kilgour, DM (Kilgour, D. Marc); Hipel, KW (Hipel, Keith W.)

Abstract

Systems methodologies to model third-party intervention in international conflicts are developed within the framework of the graph model for conflict resolution (GMCR). An inverse GMCR is introduced to utilize the GMCR as a negotiation tool by altering the procedure of the original framework. The methodologies presented give a better understanding of how decision makers (DMs) can be motivated to undertake certain actions within the conflict. Moreover, the inverse GMCR tackles the problem of specifying which preferences for DMs lead to a particular resolution, thereby making it easier for a mediator or other third party to influence the course of the conflict. The methodologies are applied to a real-world dispute, a complex water conflict in the Middle East.
12. Low cost fabrication of tandem dye-sensitized solar cells

Awais, M (Awais, M.); Shafeek, H (Shafeek, H.)

Abstract

The overall objective of this research was to deposit metal oxide semiconductor in order to construct dye-sensitized solar cell (DSSC) for converting solar energy into electric energy. It is well known that, TiO2 is the most common constituent of conventional dye-sensitized solar cell, whereas platinum counter electrode was replaced by p-type semiconductor (in this study, NiO) in order to construct tandem dye-sensitized solar cell. The main focus of this research was to prepare NiO electrodes with high surface area in order to increase its photo-conversion efficiency since p-type electrode is the limiting factor which was not allowing exploring the potential of tandem cell. In this technique, both NiO and TiO2 nanoparticles were sprayed onto the conductive glass substrates to prepare loosely adhered particulate coatings. After performing furnace sintering, both NiO and TiO2 coatings were sensitized with suitable dyes and joined together in order to prepare tandem dye-sensitized solar cells (DSSCs).

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Web of Science Categories: Chemistry, Multidisciplinary
Research Areas: Chemistry
Faculty Name: Faculty of Engineering
Department Name: Industrial Engineering
DSR No.: 7551
13. Machinability comparison of AISI 4340 and Ti-6Al-4V under cryogenic and hybrid cooling environments: A knowledge engineering approach

Al-Ghamdi, KA (Al-Ghamdi, Khalid A.); Iqbal, A (Iqbal, Asif); Hussain, G (Hussain, Ghulam)

Abstract

Efficient removal of heat from the deformation zones in machining of difficult-to-cut materials is vital for attaining viability with respect to cost and productivity. The recently embraced heat removal and lubrication methods include applications of cryogenic fluids and minimum quantity of lubrication. This article presents an experimental investigation, complemented with a fuzzy modeling approach, for comparing the efficacies of using various combinations of CO2 snow and minimum quantity of lubrication in machining two tempers each of AISI 4340 and Ti-6Al-4V. In addition, cutting speed and feed rate are also included as predictor parameters, and their effects on tool damage, machining forces, and specific cutting energy consumption are evaluated. A total of 144 experimental runs are performed for developing the fuzzy knowledge-based model, and additional 20 experiments are conducted for testing its prediction accuracy. The model is also made capable of suggesting optimal settings of the cutting parameters and the most appropriate choice of cooling against various combinations of the objectives. In a nutshell, the cooling option of applying CO2 snow at the rake and flank faces of the tool proved beneficial for machining the titanium alloy while the option of using CO2 snow at the flank face and minimum quantity of lubrication at the rake face outshone the others in the case of the alloy steel. This article claims novelty with regard to machinability comparison of AISI 4340 and Ti-6Al-4V, application of cryogenic cooling to machining of hardened steels, investigation of hybrid cooling (CO2 snow plus minimum quantity of lubrication), and intelligent modeling of cryogenic machining of AISI 4340 and Ti-6Al-4V combined.
14. Modelling sulphur dioxide levels of Konya city using artificial intelligent related to ozone, nitrogen dioxide and meteorological factors

Dursun, S (Dursun, S.); Kunt, F (Kunt, F.); Taylan, O (Taylan, O.)

Abstract

Increasing industrial developments increased the environmental pollution problems in many cities of the world. Air quality modelling and indexes are used to introduce the information on local air quality indicators in polluted regions. Estimation and monitoring of air quality in the city centres are important due to environmental health and comfort of human-related topics. Air quality approximation is a complicate subject that artificial intelligent techniques are successfully used for modelling the complicated and nonlinear approximation problems. In present study, artificial neural network and an adaptive neuro-fuzzy logic method developed to approximate the impact of certain environmental conditions on air quality and sulphur dioxide pollution level and used with this study in Konya city centre.

Data of sulphur dioxide concentrations were collected from 15 selected points of Konya city for prediction of air quality. Using air quality standards, air quality was discussed by considering the sulphur dioxide concentration as independent variables with meteorological parameters. Different meteorological parameters were used for investigation of pollution relation. One of the important modelling tools, adaptive network-based fuzzy inference system model, was used to assess performance by a number of checking data collected from different sampling stations in Konya. The outcomes of adaptive network-based fuzzy inference system model was evaluated by fuzzy quality charts and compared to the results obtained from Turkey and Environmental Protection Agency air quality standards. From the present results, fuzzy rule-based adaptive network-based fuzzy inference system model is a valuable tool prediction and assessment of air quality and tends to propagate accurate results.
15. New Approaches to Understanding Conflict Resolution Results

Kinsara, RA (Kinsara, Rami A.); Hipel, KW (Hipel, Keith W.); Kilgour, DM (Kilgour, D. Marc)

Abstract

Three approaches to better understanding conflict resolution results are discussed and applied to a trans-boundary water conflict between the United States and Canada. A decision support system, called GMCR+, is utilized to carry out the analysis and provide strategic insights. These approaches will improve and simplify the analysis process especially for larger conflict models.


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Web of Science Categories: Computer Science, Cybernetics; Computer Science, Information Systems; Computer Science, Theory & Methods
Research Areas: Computer Science
Faculty Name: Faculty of Engineering
Department Name: Industrial Engineering
DSR No.: 7526
16. Octane Rating of Gasoline and Octane Booster Additives

Demirbas, A (Demirbas, A.); Balubaid, MA (Balubaid, M. A.); Basahel, AM (Basahel, A. M.); Ahmad, W (Ahmad, W.); Sheikh, MH (Sheikh, M. H.)

Abstract

Gasoline is a petroleum-derived liquid that is used primarily as a fuel in internal combustion engines (ICE), particularly spark ignition Otto Engine. Gasoline is a blend of hydrocarbons with some contaminants, including sulfur, nitrogen, oxygen, and certain metals. The four major constituent groups of gasoline are olefins, aromatics, paraffins, and napthenes. Octane number (ON) is measure of the ignition quality or flammability of gasoline. The ONs are Research Octane Number (RON) and Motor Octane Number (MON). RON is measured relative to a mixture of isooctane and n-heptane. Antiknock Index (AKI) is a measure of a fuel's ability to resist engine knock or octane quality. The AKI is an arithmetic average of RON and MON. The ON decreases with an increase chain length in the hydrocarbon molecule. The ONs increase with carbon chain branching. Another way of increasing the ON is used gasoline octane boosters as additives, such as tetraethyl lead (TEL), methyl tertiary-butyl ether (MTBE), and ferrocene. Aromatic alcohols, ethanol, and methanol also increase the ON of gasoline. The advantage to adding oxygenates, such as MTBE, methanol, and ethanol, to gasoline is that they cause very little pollution when they burn and are cleaner fuels.

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Web of Science Categories: Energy & Fuels; Engineering, Chemical; Engineering, Petroleum
Research Areas: Energy & Fuels; Engineering
Faculty Name: Faculty of Engineering
Department Name: Industrial Engineering
DSR No.: 7805
17. **Ontology Based SMS Controller for Smart Phones**

Balubaid, MA (Balubaid, Mohammed A.); Manzoor, U (Manzoor, Umar); Zafar, B (Zafar, Bassam); Qureshi, A (Qureshi, Abdullah); Ghani, N (Ghani, Numairul)

**Abstract**

Text analysis includes lexical analysis of the text and has been widely studied and used in diverse applications. In the last decade, researchers have proposed many efficient solutions to analyze / classify large text dataset, however, analysis / classification of short text is still a challenge because 1) the data is very sparse 2) It contains noise words and 3) it is difficult to understand the syntactical structure of the text. Short Messaging Service (SMS) is a text messaging service for mobile/smart phone and this service is frequently used by all mobile users. Because of the popularity of SMS service, marketing companies nowadays are also using this service for direct marketing also known as SMS marketing. In this paper, we have proposed Ontology based SMS Controller which analyze the text message and classify it using ontology as legitimate or spam. The proposed system has been tested on different scenarios and experimental results shows that the proposed solution is effective both in terms of efficiency and time.

**Sources**

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Publisher: SCIENCE & INFORMATION SAI ORGANIZATION LTD
Web of Science Categories: Computer Science, Theory & Methods
Research Areas: Computer Science
Faculty Name: Faculty of Engineering
Department Name: Industrial Engineering
DSR No.: 7840
18. **Ontology-Based Clinical Decision Support System for Predicting High-Risk Pregnant Woman**

Manzoor, U (Manzoor, Umar); Balubaid, MA (Balubaid, Mohammed A.); Usman, M (Usman, Muhammad); Mueen, A (Mueen, Ahmed)

**Abstract**

According to Pakistan Medical and Dental Council (PMDC), Pakistan is facing a shortage of approximately 182,000 medical doctors. Due to the shortage of doctors; a large number of lives are in danger especially pregnant woman. A large number of pregnant women die every year due to pregnancy complications, and usually the reason behind their death is that the complications are not timely handled. In this paper, we proposed ontology-based clinical decision support system that diagnoses high-risk pregnant women and refer them to the qualified medical doctors for timely treatment. The Ontology of the proposed system is built automatically and enhanced afterward using doctor’s feedback. The proposed framework has been tested on a large number of test cases; experimental results are satisfactory and support the implementation of the solution.

**Sources**

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- **Web of Science Categories**: Computer Science, Theory & Methods
- **Research Areas**: Computer Science
- **Faculty Name**: Faculty of Engineering
- **Department Name**: Industrial Engineering
- **DSR No.**: 4264
19. Pyrolytic Distillation of No. 4 Fuel Oil

Demirbas, A (Demirbas, A.)

Abstract

Fuel oils (numbers 1-6) are fractions of crude oil. The boiling point and carbon chain length of the fuel increases with fuel oil number. Viscosity increases with the number, and is needed to flow the heated heavy oil. No. 4 fuel oils are used as burner fuel for domestic and industrial heating and have to raise steam for power generation and marine propulsion. Recycling and rerefining are application processes for the treatment of petroleum-based heavy products by converting into reusable light products such as gasoline and No. 2 diesel fuel. Possible pyrolysis and cracking processes are appropriate. The purpose of this study is performed to obtain light products, especially gasoline and No. 2 diesel fuel from No. 4 fuel oil by the method of pyrolytic distillation. Sodium carbonate (Na2CO3) was used in pyrolysis as catalyst and the purified oil samples were blended separately with catalysts having a mass basis of 5% and 10%. If the objective is to maximize the yield of distillate producing from No. 4 fuel oil, a low temperature and a high heating rate process would be required. The yield of gasoline-like fuel was 10.6% in the noncatalytic conversion, while 13.3% was obtained in the catalytic conversion. The yield of No. 2 diesel-like fuel was 23.3% in the noncatalytic conversion, while of 32.6% was obtained in the catalytic conversion. The yield of No. 2 diesel-like obtained from the catalytic conversion was higher than that of the noncatalytic conversion.
20. Recovery of Gasoline and Diesel Range Hydrocarbons From Waste Vegetable Oils

Demirbas, A (Demirbas, A.)

Abstract

In general, vegetable oils are triglycerides, which consist of 18-carbon fatty acids. There is no boiling point of vegetable oils, because oils start to decompose when heated to a certain temperature after removing smoke. The smoke point is the temperature at which the oil is decomposed and where possibly toxicological relevant compounds are formed. There is a very small amount of hydrocarbons in the content of vegetable oils. Thermal cracking of triglycerides has been carried out for over 100 years, with a recent focus on converting fats and oils to liquid fuels. Catalytic pyrolysis and cracking processing have the potential to become an important process for conversion of vegetable oils into gasoline and diesel range hydrocarbons. Decarboxylation and deoxygenation mainly occur during pyrolysis and cracking reactions.

Demirbas, A (Demirbas, A.); Taylan, O (Taylan, O.)

Abstract

A solid waste management system based on the 3R principle: reduce, reuse, and recycle. There are two major recycling methods for conversion of plastic wastes to synthetic fuels: (a) pyrolysis in absence and presence of catalyst and (b) thermal and/or catalytic cracking. Pyrolysis is a complex series of chemical and thermal reactions to decompose or depolymerize organic material under oxygen-free conditions. The most affecting variables of plastic pyrolysis are catalyst type and shape, temperature, and residence time. Certain types of waste plastics such as polystyrene (PS), polyethylene (PE), and polypropylene (PP) are generally used in pyrolysis. The plastic wastes can be pyrolyzed into liquid, gas, and solid residue products. The pyrolysis of plastic wastes produces a whole spectrum of hydrocarbons including paraffins, olefins, naphthalenes, and aromatics. The total yields of paraffins and olefins of PE and PP wastes obtained by pyrolysis were higher than that of PS. The oil obtained from plastic pyrolysis could improve performance by modifying engine. The addition of catalyst in the pyrolysis can be a more efficient method to produce high valuable products with mainly gasoline-range hydrocarbons. The catalytic decomposition was produced much more light hydrocarbons than that of thermal decomposition. Especially, ZSM-5 with a smaller pore size, rather than that of zeolite Y was more cracked into light hydrocarbons such as C6-C12 hydrocarbons and gas products.
22. Relationships Between Specific Gravities and Higher Heating Values of Petroleum Components

Demirbas, A (Demirbas, A.); Al-Ghamdi, K (Al-Ghamdi, K.)

Abstract

The aim of this study was to estimate mathematical relationships between higher heating value (HHV) and specific gravity of petroleum fuels. The HHV is an important property defining the energy content of petroleum related fuels. The specific gravities of petroleum fuels generally range from 0.56 to 0.92 (based on the specific gravity of pure water is 1 at 15.6 degrees C). There is high regression between specific gravity and HHVs for petroleum fuels. An increase in specific gravity from 0.56 to 0.92 for petroleum fuels decreases the HHVs from 50.4 to 41.6 and the decreases are highly regular. The HHV (MJ/kg) of the petroleum sample as a function of the specific gravity of petroleum constituent can be calculated from: For aliphatics and alicyclics \( \text{HHV} = -21.63SG + 62.88 \) For aromatics \( \text{HHV} = -2.67SG + 39.23 \) According to the two equations, higher heating value of petroleum is a function of the specific gravity of petroleum constituent. The HHVs (MJ/kg) of the crude oil samples as a function of carbon (C), hydrogen (H), oxygen (O), nitrogen (N), and sulfur (S) can be calculated from the following equation: \( \text{HHV} = 31.6(C) + 142.3(H) + 30.8(S) - 15.4(O) - 14.5(N) \)

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Web of Science Categories : Energy & Fuels; Engineering, Chemical; Engineering, Petroleum
Research Areas : Energy & Fuels; Engineering
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Department Name : Industrial Engineering
DSR No. : 7994
23. Selection of compressors for petrochemical industry in terms of reliability, energy consumption and maintenance costs examining different scenarios

Sapmaz, S (Sapmaz, Suleyman); Kilic, FC (Kilic, Fatma Canka); Eyidogan, M (Eyidogan, Muharrem); Taylan, O (Taylan, Osman); Coban, V (Coban, Volkan); Cagman, S (Cagman, Selman); Kilicaslan, I (Kilicaslan, Ibrahim); Kaya, D (Kaya, Durmus)

Abstract

In this study, based on some important criteria, qualitative and quantitative evaluations were presented for the selection of compressors used in compressed air systems, in a petrochemical industry. Four different scenarios were investigated according to the main criteria considered for the selection of the compressors such as reliability, energy efficiency, investment, and maintenance costs. The types of compressor and their capacities were analyzed and compared. In Scenario I, the currently active electrically driven compressors were considered as backup compressors, instead of them, a new unit turbo compressor and two units of VSD screw compressors were purchased as active compressors. In this scenario, the initial investment cost is low and standby steam consumption is reduced due to the fact that the backup compressors are electrically driven. In Scenario II all active and backup compressors are replaced by a new one, which is proposed to be electrically driven. In this scenario, the initial investment cost is high, but energy consumption is very low. In Scenario III, all active compressors are planned to be replaced by new backup steam-driven compressors. In this scenario, although the initial investment costs and energy consumption are high, the reliability of this scenario is higher than the reliability of Scenarios I and II. In Scenario IV, all compressors are projected to be replaced by new and equivalent compressors. In this scenario, the initial investment cost and energy consumption are high, but the reliability of this scenario is the highest comparing all other scenarios. The aim of this study is to contribute the studies on the selection of compressors by considering some important parameters as their types and capacities, in particular, for industrial enterprises that have risk of explosion like in the petrochemical industry.

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Publisher: MULTI-SCIENCE PUBL CO LTD
Web of Science Categories: Energy & Fuels
Research Areas: Energy & Fuels
Faculty Name: Faculty of Engineering
Department Name: Industrial Engineering
DSR No.: 8111
Abstract

Turkey is at the crossroads of Europe and several volatile and strategically and economically important regions, including the Caspian Sea basin region, the Middle East, and Russia. Turkey is the most important part of Caspian Sea Basin-Middle East-Turkey triangle. Its location on two continents plays a central part in Turkish history and gives the country a major advantage in serving the markets of Europe, the Middle East, Central Asia, and North Africa. Turkey's geopolitical situation will play possible important role in regional politics in the near future. Turkey's domestic energy sources especially new petroleum reserves will become important in the future. Petroleum plays very important role in foreign policies and their international relations of Caspian and Middle East countries. The Middle East itself produces 32% of the world's oil, but even more impressive is they have 64% of the total proven oil reserves in the world.
25. The pillowing tendency of materials in single-point incremental forming: Experimental and finite element analyses

Al-Ghamdi, KA (Al-Ghamdi, K. A.); Hussain, G (Hussain, G.)

Abstract

The pillow is a defect that adversely affects the geometrical accuracy as well as the formability in single-point incremental forming. With a main objective to control this defect, the effects of mechanical properties of material on pillowing are examined in this work. To identify the mechanical property that significantly affects pillowing, single-point incremental forming tests are conducted using a variety of materials (i.e. 11). It is found that a property (i.e. area reduction at tensile fracture) that controls the formability of a material in single-point incremental forming does not have any significant effect on its pillowing tendency. Interestingly, hardening exponent (i.e. a property that has controlling influence on the stretch-ability of material) appears to be the most influential property that determines the pillowing tendency of sheet metals in single-point incremental forming. Furthermore, the pillowing tendency of a material decreases with the decrease in this particular property. This, according to finite element analysis, occurs because strain localization around the tool(sheet contact correspondingly increases. To select and rank materials with respect to the pillowing behavior, a formula describing the property-pillowing relationship is proposed. As a secondary objective, the correlation between pillowing and forming depth is also investigated in this work. It is shown that initially the pillow progresses as the forming depth increases. However, after forming has been carried out to a certain depth, the pillow begins to regress, most likely due to strain hardening of sheet metal. In conclusion, it is suggested to lower the hardening exponent of sheet metals in order to control pillowing in single-point incremental forming.
26. The Pyrolizing of Waste Lubricating Oil (WLO) Into Diesel Fuel Over a Supported Calcium Oxide Additive

Aburas, H (Aburas, H.); Bafail, A (Bafail, A.); Demirbas, A (Demirbas, A.)

Abstract

Most the lubricant oils are generally obtained from petroleum resources. Waste lubricating oil can be converted into valuable fuel products by refining and treating processes. Recycling is the applicable process for upgrading of petroleum-based wastes by converting them into reusable products such as gasoline, diesel fuel, and heavy oil. Possible acceptable processes are cracking and pyrolysis. A pyrolytic distillation process is often employed in oil refinery operations to produce lower molecular weight hydrocarbon fuels from waste feedstocks. If the purpose is to maximize the yield of distillate products resulting from lubricant oil pyrolysis, a low temperature, high heating rate, and short gas residence time process would be required. The effect of calcium oxide (CaO) as additive on density, viscosity, flash point, sulfur content, higher heating value, and pyrolytic distillation yields was investigated. The purified oil samples are blended separately with additives having mass bases of 2%, 4%, 6%, 8%, and 10%.

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Faculty Name: Faculty of Engineering
Department Name: Industrial Engineering
DSR No.: 8237
Threshold tool-radius condition maximizing the formability in SPIF considering a variety of materials: Experimental and FE investigations

Al-Ghamdi, KA (Al-Ghamdi, K. A.); Hussain, G (Hussain, G.)

Abstract

In the current study, a new level of understanding on the influence of using small tool radii on the formability (theta(max)) is identified for single point incremental forming (SPIF). The relative value of tool radius and blank thickness (i.e., R/T-B, where R is the tool radius and TB is the blank thickness) was varied over a range (from 1.1 to 3.9), and a formability diagram in the R/T-B-theta(max) space was obtained. The formability was observed to show an inverse V-type pattern which revealed that there is a critical radius of tool (R-c) that maximizes the formability in SPIF. Further, this radius which was found to be independent of the material type (or property) is a function of blank thickness related as, R-c approximate to 2.2T(B). This radius was termed as threshold radius. The formability, in agreement with general opinion in the literature, was noticed to increase with the decrease in the tool radius above the threshold value. However, contrarily it reduced with the decrease in the tool radius below the threshold value. In fact, undue surface cutting and metal squeezing was detected when the tests were performed with pointed tools, i.e., below threshold radius. This unstable deformation, which according to the FE analyses was found to be an outgrowth of in-plane compression under the tool center, increasingly weakened the material by inducing corresponding increase in damage (quantified by stress triaxiality) with the decrease in the tool radius. On the other hand, the damage was also observed to increase due to decrease in compression with the increase in the tool radius above the threshold value. This revealed high compression with low damage constitutes the most conducive condition that maximizes the formability in SPIF, which is realized when R approximate to 2.2T(B). (C) 2014 Elsevier Ltd. All rights reserved.
Utilization of Surfactant Flooding Processes for Enhanced Oil Recovery (EOR)

Demirbas, A (Demirbas, A.); Alsulami, HE (Alsulami, H. E.); Hassanein, WS (Hassanein, W. S.)

Abstract

Surfactant flooding is a well-known enhanced oil recovery (EOR) technique that has been used worldwide for decades. The surfactant can meaningfully lower interfacial tension and change the wetting properties. Surfactant related recovery processes are of increasing interest and importance because of high oil prices and the urge to meet energy demand. The water flooding methods include chemical flooding and low-salinity water (LSW) flooding. Chemical flooding methods have been developed to recover residual oil trapped after conventional oil recovery is getting important recovery. The LSW flooding includes injecting brine with a lower content of salt or ionic strength. Water flooding improves oil recovery by displacing oil, and injection water is usually taken from the nearest available source. The injected alkali and surfactant, so that the interfacial tension between oil and water is lowered and thus residual oil can move. There is a relationship among chemical EOR efficiency and fluid viscosity, relative permeability, interfacial tension, wettability, and capillary pressure. The polymer increases the viscosity of the flooding water, reduces water mobility, and thus greatly reduces oil flow ratio so to reduce water flooding fingering, improve horizontal and microscopic pore structure reservoir heterogeneity condition, relieve channeling flow around other phenomena, and increase the flooding swept volume of water.

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Reprint Address: Demirbas, A (reprint author), King Abdulaziz Univ, Dept Ind Engn, Fac Engn, Jeddah 21413, Saudi Arabia.
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Web of Science Categories: Energy & Fuels; Engineering, Chemical; Engineering, Petroleum
Research Areas: Energy & Fuels; Engineering
Faculty Name: Faculty of Engineering
Department Name: Industrial Engineering
DSR No: 7806
DEPARTMENT OF
MINING ENGINEERING
1. Cu-0-doped TiO2 nanofibers as potential photocatalyst and antimicrobial agent

Yousef, A (Yousef, Ayman); El-Halwany, MM (El-Halwany, M. M.); Barakat, NAM (Barakat, Nasser A. M.); Al-Maghrabi, MN (Al-Maghrabi, Mohammednoor N.); Kim, HY (Kim, Hak Yong)

Abstract

Cu-0 nanoparticles (NPs)-doped TiO2 nanofibers (NFs) were prepared as an effective photodegradation of three azo dyes as well as an antimicrobial agent under visible light. Fabrication of one dimensional zerovalent Cu nanoparticles-doped TiO2 nanofibers with high aspect ratio have been successfully synthesized by simple and low cost; electrospinning technique followed by hydrothermal process. The photocatalytic activity of introduced nanofibers was evaluated by performing of three azo dyes. Catalytic NFs show a superior photodegradation activity under visible light as well as good antimicrobial activity. Moreover, photocatalyst nanofibers appeared good stability, which was used for three cycles without regeneration. (C) 2014 The Korean Society of Industrial and Engineering Chemistry. Published by Elsevier B.V. All rights reserved.
2. **Exploitation of limestone in brick making**

Abdelhaffez, GS (Abdelhaffez, Gamal Saad); Ahmed, AAM (Ahmed, Ahmed Abdul Mageed)

**Abstract**

In Egypt, large amounts of limestone dust are accumulated in running limestone quarries every year. Disposal of these wastes is a rapidly growing problem and causes certain serious environmental problems as well as health hazards. Therefore, research for utilizing these disposals is urgently needed. The main aim of this study is to investigate both physical and mechanical properties of brick specimens containing combinations of limestone dust and small amount of Portland cement as a binder for producing house building brick. Limestone dust and cement were mixed, humidified and molded by two methods, manual method and mechanical molding method. After demolding, the produced specimens were dried in air at room temperature for 28 days. The obtained values of water absorption, bulk density, slake durability index and compressive strength satisfy the Egyptian standard of fired clay building units for non-load bearing walls. The test results indicate that brick specimens contain 14 % cement which satisfy the requirements of building of non-load bearing walls in Egypt. The process undertaken can easily be applied in the working Egyptian brick plants using semi mechanization system. The positive use of these wastes converts them into useful products, saving natural resources and can alleviate the disposal and environmental problems.

**Sources**

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Publisher: CARL HANSER VERLAG
Web of Science Categories: Materials Science, Characterization & Testing
Research Areas: Materials Science
Faculty Name: Faculty of Engineering
Department Name: Mining Engineering
DSR No.: 6639
3. Processing of Saudi talc ore for filler industries - Part 2: Magnetic separation and flotation

Ahmed, HAM (Ahmed, Hussin A. M.)

Abstract

Kingdom of Saudi Arabia has huge low grade talc deposits with high iron content (7.63 % Fe₂O₃) and low silica content (55.43 % SiO₂). This paper aims at investigating the amenability of processing the ore to meet filler specifications. This was firstly tried using wet or dry magnetic separation. Secondly, the ore was upgraded using flotation. In applying magnetic separation technique, Carpco induced roll and Boxmag Rapid magnetic separators were used. The main studied variables were: magnetic field intensity, the Carpco roll speed, feed rate and feed size. Denver D-12 flotation cell was used for flotation tests. The parameters pH value, pulp density, collector type and dose were optimized. The obtained results showed that using Carpco dry magnetic separator at optimum conditions produces a talc concentrate having 1.49 % Fe₂O₃. Wet magnetic separation under optimum conditions using Boxmag can lead to a talc concentrate having 1.33 % Fe₂O₃. The cleanest flotation concentrate has an iron content of 1.12 % Fe₂O₃. All these products can be used as filler in paper industry only. However, using flotation for cleaning the Carpco concentrate resulted in a final concentrate of 0.69 % Fe₂O₃ and 63.23 % SiO₂ which has many industrial applications especially as filler.
4. Processing of Saudi talc ore for filler industries - Part 2: Magnetic separation and flotation

Ahmed, HAM (Ahmed, Hussin A. M.)

Abstract

Kingdom of Saudi Arabia has huge low grade talc deposits with high iron content (7.63 % Fe₂O₃) and low silica content (55.43 % SiO₂). This paper aims at investigating the amenability of processing the ore to meet filler specifications. This was firstly tried using wet or dry magnetic separation. Secondly, the ore was upgraded using flotation. In applying magnetic separation technique, Carpco induced roll and Boxmag Rapid magnetic separators were used. The main studied variables were: magnetic field intensity, the Carpco roll speed, feed rate and feed size. Denver D-12 flotation cell was used for flotation tests. The parameters pH value, pulp density, collector type and dose were optimized. The obtained results showed that using Carpco dry magnetic separator at optimum conditions produces a talc concentrate having 1.49 % Fe₂O₃. Wet magnetic separation under optimum conditions using Boxmag can lead to a talc concentrate having 1.33 % Fe₂O₃. The cleanest flotation concentrate has an iron content of 1.12 % Fe₂O₃. All these products can be used as filler in paper industry only. However, using flotation for cleaning the Carpco concentrate resulted in a final concentrate of 0.69 % Fe₂O₃ and 63.23 % SiO₂ which has many industrial applications especially as filler.
5. Solar photoradiation-induced oxidation of NOM from surface water using immobilized coated glass spirals of TiO2

Ghaly, MY (Ghaly, Montaser Y.); Al-Maghrabi, MNN (Al-Maghrabi, Mohammed Noor N.); Ismail, E (Ismail, Ebrahim); Ali, MEM (Ali, Mohamed Eid M.)

Abstract

The Advanced oxidation processes sunlight/photocatalyst is common for remediation treatments. During the oxidation processes, organic matter decomposed into smaller compounds, which affect the characteristics of the treated effluent. In the present work, two types of commercial TiO2 (TiO2 P-25 Degussa and commercial TiO2 (A)) were supported on small glass spirals. The photooxidation of natural organic matters (NOMs) over immobilized TiO2 using parabolic solar collector was investigated. The effects of addition of H2O2 as electron acceptor and pH values were also investigated. The degradation of NOMs was followed up by analysis of total organic carbon (TOC) and UV absorbance at 254 nm (A(254)). It was found that NOMs were completely removed over immobilized TiO2 on glass spirals under sunlight irradiation after 120 min. Also, approximately 77% of TOC was reduced from groundwater. Upon obtained results, solar energy could be used for photocatalytic degradation of NOMs in ground and surface waters and therewith lighten the process of preparing them to the potable water.
DEPARTMENT OF
NUCLEAR ENGINEERING
1. A Method to Maximize the Amplitude of Generated Terahertz Pulse From LT GaAs Photoconductive Semiconductor Switch

Ray, S (Ray, Sampad); Alla, A (Alla, Arun); Naz, S (Naz, Sabiha); Alnahwi, F (Alnahwi, Falih); Islam, NE (Islam, Naz E.); Al-Aufi, A (Al-Aufi, Abdurrahman)

Abstract

The substrate characteristics of GaAs photoconductive switch has been studied in order to determine the conditions required to generate maximum terahertz pulse amplitude in the device. In particular, the substrate material characteristics, such as trap density, capture cross sections, trap occupancy that determine fields, recombination rate, and photogeneration that influence the pulse rise-time in a low temperature grown gallium arsenide semiinsulating material, are studied. Results show that maximum pulse amplitude occurs when the carriers of both polarities contribute to the terminal currents, and the voltage at this point is referred to as the dual injection voltage (DIV). DIV for a given device is directly dependent on the substrate properties as well as the proximity of the electrodes.
2. Evaluation of Uranium Concentration in Soil Samples of Central Jordan

Xoubi, N (Xoubi, Ned)

Abstract

Naturally occurring radionuclides such as uranium, thorium and their decay products (Ra-226, Rn-222) are present in a number of geological settings in Jordan. Motivated by the existence of uranium anomalies coupled with its lack of conventional energy resources, Jordan decided that the development of this indigenes resource (uranium) is the first step in introducing nuclear power as part of its energy mix. Uranium deposits in Central Jordan were perceived not only as a secured resource that will fulfill Jordan's energy needs, but also as an economic asset that will finance Jordan's nuclear program. The average uranium concentration of 236 soil samples using ICP-Mass (inductively coupled plasma mass spectrometry) was found to be 109 parts per million (ppm). Results analysis revealed a wide range of 1066 ppm for uranium concentration, and a median of 41 ppm uranium. The measurements frequency distribution indicates that 72% of samples measured had a uranium content of less than 100 ppm, a concentration that characterizes overburden and tailings quality, rather than minable reserves. This paper presents and evaluates the concentration of uranium in central Jordan, being the most promising area with the highest radioactive anomalies in Jordan.

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Publisher: MDPI AG
Web of Science Categories: Mineralogy; Mining & Mineral Processing
Research Areas: Mineralogy; Mining & Mineral Processing
Faculty Name: Faculty of Engineering
Department Name: Nuclear Engineering
DSR No.: 6099
3. High-Level Radioactive Waste Storage Feasibility for the Kingdom of Saudi Arabia

Al-Othmany, DS (Al-Othmany, Dheya Shujaa); Hussain, A (Hussain, Ahmad); Banoqitah, E (Banoqitah, Essam)

Abstract

With the inception of King Abdullah City of Atomic and Renewable Energy in the Kingdom, the future of nuclear power looks promising in near future. Although nuclear power will help solve the energy-related issues of the country, however, the high-level radioactive waste has to be stored securely. In this regard, an evaluation of the available geological data has been conducted to determine where the most suitable sites could serve as permanent disposal of radioactive wastes from future nuclear power activities in the Kingdom of Saudi Arabia. Also, the volume of high-level wastes expected to be generated have been estimated, so as to access the cost (and size) of such a disposal site. Conclusions are presented, indicating that by the year 2060, the construction of such a disposal site would be economically feasible, based upon a surcharge of 1 mill/kWh for the disposal activities. The site selection is tentative and very preliminary, since actual core drillings and other geologic assessments will be required before a site can be seriously proposed.

Sources

ISO Source Abbrev: ARABIAN JOURNAL FOR SCIENCE AND ENGINEERING
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Reprint Address: Hussain, A (reprint author), King Abdulaziz Univ, Dept Nucl Engr, Jeddah 21413, Saudi Arabia.
Publisher: SPRINGER HEIDELBERG
Web of Science Categories: Multidisciplinary Sciences
Research Areas: Science & Technology - Other Topics
Faculty Name: Faculty of Engineering
Department Name: Nuclear Engineering
DSR No.: 8320
4. Impact of the Surface Morphology on the Combustion of Simulated Solid Rocket Motor

Hegab, AM (Hegab, Abdelkarim M.); Sait, HH (Sait, Hani Hussain); Hussain, A (Hussain, Ahmad)

Abstract

An advanced and intensive computational solution development is integrated with an asymptotic technique, to examine the impact of the combustion surface morphology on the generated rotational flow field in a solid rocket chamber with wide ranges of forcing frequencies. The simulated rectangular chamber is closed at one end and is open at the aft end. The upper and lower walls are permeable to allow steady and unsteady injected air to generate internal flow mimicking the flow field of the combustion gases in real rocket chamber. The frequencies of the unsteady injected flow are chosen to be very close or away from the resonance frequencies of the adapted chamber. The current study accounts for a wide range of wave numbers that reflect the complexity of real burning processes. Detailed derivation for Navier-Stokes equations at the four boundaries of the chamber is introduced in the current study. Qualitative comparison is performed with recent experimental work carried out on a two-inch hybrid rocket motor using a mixture of polyethylene and aluminum powder. The higher the percentage of aluminum powder in the mixture, the more the corrugations of the combustion surface. This trend is almost similar to the computational and analytical results of a simulated solid rocket chamber.
5. Neutron production from flattening filter free high energy medical linac: A Monte Carlo study

Najem, MA (Najem, M. A.); Abolaban, FA (Abolaban, F. A.); Podolyak, Z (Podolyak, Z.); Spyrou, NM (Spyrou, N. M.)

Abstract

One of the problems arising from using a conventional linac at high energy (>8 MV) is the production of neutrons. One way to reduce neutron production is to remove the flattening filter (FF). The main purpose of this work was to study the effect of FF removal on neutron fluence and neutron dose equivalent inside the treatment room at different photon beam energies. Several simulations based on Monte Carlo techniques were carried out in order to calculate the neutron fluence at different locations in the treatment room from different linac energies with and without a FF. In addition, a step-and-shoot intensity modulated radiotherapy (SnS IMRT) for prostate cancer was modelled using the 15 MV photon beam with and without a FF on a water phantom to calculate the neutron dose received in a full treatment. The results obtained show a significant drop-off in neutrons fluence and dose equivalent when the FF was removed. For example, the neutron fluence was decreased by 54%, 76% and 75% for 10, 15 and 18 MV, respectively. This can decrease the neutron dose to the patient as well as reduce the shielding cost of the treatment room. The neutron dose equivalent of the SnS IMRT for prostate cancer was reduced significantly by 71.3% when the FF was removed. It can be concluded that the flattening filter removal from the head of the linac could reduce the risk of causing secondary cancers and the shielding cost of radiotherapy treatment rooms. (C) 2015 Elsevier Ltd. All rights reserved.
6. PMMA MICROFIBER COATED WITH AL-DOPED ZNO NANOSTRUCTURES FOR DETECTING URIC ACID

Irawati, N (Irawati, N.); Harun, SW (Harun, S. W.); Adwan, S (Adwan, S.); Alnowami, M (Alnowami, M.); Ahmad, H (Ahmad, H.)

Abstract

A biosensor is demonstrated using the fabricated polymethyl methacrylate (PMMA) microfiber, which is coated with Al-doped ZnO nanostructure using a sol-gel process, used as the probe. The change in the transmitted light intensity from the PMMA microfiber-based sensor with the increase in uric acid concentration is investigated. It is observed that the light power linearly decreases with the increase in uric acid concentration. As the uric acid concentration increases from 0 to 500 ppm, the transmitted light intensity reduces from 231.54 to -36.54 dBm. It is found that the sensor has a sensitivity of 0.010 dB/ppm with a good linearity of more than 99%. (C) 2015 Wiley Periodicals, Inc.
7. STEADY STATE AND TRANSIENT THERMALHYDRAULIC ANALYSIS OF PHWR USING COBRA-3C/RERTR

Hussain, A (Hussain, A.); Abolaban, F (Abolaban, F.); Khubaib, SM (Khubaib, S. M.);
Mubin, S (Mubin, S.); Ahmed, I (Ahmed, I.)

Abstract

Nuclear cross sections that determine core multiplication strongly depend on core temperature (e.g., the Doppler, moderator density effects etc). On the other hand, since this heat is generated by the neutron flux in the reactor core, the temperature distribution in the core will depend heavily on its neutronic behavior. Fuel centerline temperature could be the limiting constraint on reactor power because of the concern for fuel melting. Likewise, high clad temperature is also a possible limiting factor on reactor power because of the potential degradation of clad material or on-set of critical heat flux phenomenon. An assessment of the steady state and transient thermal hydraulic capabilities of the computer code COBRA 3C/RERTR was made using model for a PHWRs reactor core. The temperature distributions determined for fuel, clad and coolant are compared with analytical results and with the results quoted in safety report. It was found that when the code was run for full power at reduced flow of 70% the bulk coolant temperature remained below the saturation temperature, so there is an adequate design margin is available for safety related scenarios.

Sources: IRANIAN JOURNAL OF SCIENCE AND TECHNOLOGY-TRANSACTIONS OF MECHANICAL ENGINEERING

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Reprint Address: Hussain, A (reprint author), King Abdulaziz Univ, Dept Nucl Engn, Jeddah 21413, Saudi Arabia.
Publisher: SHIRAZ UNIV
Web of Science Categories: Engineering, Mechanical
Research Areas: Engineering
Faculty Name: Faculty of Engineering
Department Name: Nuclear Engineering
DSR No.: 6317
8. Unsupervised and Precise Tracking of Brain Parenchyma Volume Using Dual Spin Echo T2 Weighted MR Data

Alyassin, AM (Alyassin, Abdalmajeid M.)

Abstract

The purpose of this research is to provide an unsupervised precise measurement technique in tracking the change of brain parenchyma volume over time. Tracking this change can be a very useful imaging metric for neurological patients who may develop brain dementia overtime. This technique should help in assessing the patient diagnosis, progress, and response to medication. A novel unsupervised segmentation technique was developed to measure the brain parenchyma volume with a high degree of precision. The technique consisted of two stages. The first stage used a novel manner of multi-spectral analysis and the second stage used a series of morphological filters coupled with several logical image operators to remove possible segmentation outliers. This technique required dual spin echo T2 weighted MR data of the brain. Twenty MR data sets were segmented and the accuracy was evaluated visually and found to be free of outliers. The precision of the technique was tested on a series of MR data sets for two normal subjects. Each series consisted of seven MR data sets per subject scanned over a month period. The percent brain parenchyma was calculated for the two subjects with a percent coefficient of variation of less than 0.4%. The technique ran on a standard personal computer in less than 30 seconds per data set without user interaction. This research provided an unsupervised, precise, and fast technique to track the progression of change in brain parenchyma volume.
DEPARTMENT OF
PRODUCTION ENGINEERING AND MECHANICAL
SYSTEM DESIGN
1. A comparative study of almond and palm oils as two bio-diesel fuels for diesel engine in terms of emissions and performance

Abu-Hamdeh, NH (Abu-Hamdeh, Nidal H.); Alnefaie, KA (Alnefaie, Khaled A.)

Abstract

This study was initiated to investigate the various performance parameters and emissions of a single cylinder diesel engine operating on almond biodiesel and compare them to the performance and emissions when the engine is operated on palm oil biodiesel and 'baseline' diesel fuel through laboratory measurements. Different fuel blends containing 0%, 10%, 30% and 50% on volume basis of almond biodiesel with diesel fuel were tested. Another fuel blends consist of 0%, 10%, 30% and 50% on volume basis of palm oil biodiesel in a palm biodiesel-diesel fuel were also tested. The influence of these blends on emissions and some performance parameters under various load conditions were inspected. Compared to the results obtained using palm oil biodiesel, almond biodiesel resulted in improved performance over the load range considered as indicated by lower brake specific fuel consumption, higher thermal efficiency, and higher exhaust gas temperature. In terms of emissions, almond biodiesel resulted in lower carbon monoxide (CO), oxides of nitrogen (NOx), total particulate and unburned fuel emissions in the exhaust gas. (C) 2015 Elsevier Ltd. All rights reserved.

Abu-Hamdeh, NH (Abu-Hamdeh, Nidal H.); Alnefaie, KA (Alnefaie, Khaled A.)

Abstract

This paper investigates the opportunity of using almond oil as a renewable and alternative fuel source. Different fuel blends containing 10, 30, and 50% almond biodiesel (B10, B30, and B50) with diesel fuel (B0) were prepared and the influence of these blends on emissions and some performance parameters under various load conditions were inspected using a diesel engine. Measured engine performance parameters have generally shown a slight increase in exhaust gas temperature and in brake specific fuel consumption and a slight decrease in brake thermal efficiency. Gases investigated were carbon monoxide (CO) and oxides of nitrogen (NOx). Furthermore, the concentration of the total particulate and the unburned fuel emissions in the exhaust gas were tested. A blend of almond biodiesel with diesel fuel gradually reduced the engine CO and total particulate emissions compared to diesel fuel alone. This reduction increased with more almond biodiesel blended into the fuel. Finally, a slight increase in engine NOx using blends of almond biodiesel was measured.

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Reprint Address: Abu-Hamdeh, NH (reprint author), King Abdulaziz Univ, Fac Engn, Dept Mech Engn, POB 80204, Jeddah 21589, Saudi Arabia.
Publisher: HINDAWI PUBLISHING CORP
Web of Science Categories: Biotechnology & Applied Microbiology; Medicine, Research & Experimental Medicine
Research Areas: Biotechnology & Applied Microbiology; Research & Experimental Medicine
Faculty Name: Faculty of Engineering
Department Name: Production Engineering and Mechanical System Design
DSR No.: 8059
3. A statistical descriptor based volume-integral micromechanics model of heterogeneous material with arbitrary inclusion shape

Liu, ZL (Liu, Zeliang); Moore, JA (Moore, John A.); Aldousari, SM (Aldousari, Saad M.); Hedia, HS (Hedia, Hassan S.); Asiri, SA (Asiri, Saeed A.); Liu, WK (Liu, Wing Kam)

Abstract

A continuing challenge in computational materials design is developing a model to link the microstructure of a material to its material properties in both an accurate and computationally efficient manner. In this paper, such a model is developed which uses image-based data from characterization studies combined with a newly developed self-consistent volume-integral micromechanics model (SVIM) for linear elastic material. It is observed that SVIM is able to capture the effective stress/strain distribution inside the inclusion, as well as effects of volume fraction and nearest inclusion distance on the effective properties of heterogeneous material. More importantly, SVIM can be applied to inclusions with arbitrary shape through discretizing the inclusion domain. For both 2-dimensional and 3-dimensional problems with circular and spherical inhomogeneities, SVIM’s capability of predicting effective elastic properties is validated against experiments and direct numerical simulations using the finite element method. Finally, the effect of inclusion shape is predicted by SVIM.

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Language: English
Document Type: Article
Reprint Address: Liu, WK (reprint author), Northwestern Univ, Dept Mech Engn, Evanston, IL 60208 USA.
Publisher: SPRINGER
Web of Science Categories: Mathematics, Interdisciplinary Applications; Mechanics
Research Areas: Mathematics; Mechanics
Faculty Name: Faculty of Engineering
Department Name: Production Engineering and Mechanical System Design
DSR No.: 6323
4. A theory for bone resorption based on the local rupture of osteocytes cells connections: A finite element study

Ridha, H (Ridha, Hambl); Almitani, KH (Almitani, Khalid H.); Chamekh, A (Chamekh, Abdessalem); Toumi, H (Toumi, Hechmi); Tavares, JMRS (Tavares, Joao Manuel R. S.)

Abstract

In this work, a bone damage resorption finite element model based on the disruption of the inhibitory signal transmitted between osteocytes cells in bone due to damage accumulation is developed and discussed. A strain-based stimulus function coupled to a damage-dependent spatial function is proposed to represent the connection between two osteocytes embedded in the bone tissue. The signal is transmitted to the bone surface to activate bone resorption. The proposed model is based on the idea that the osteocyte signal reduction is not related to the reduction of the stimulus sensed locally by osteocytes due to damage, but to the difficulties for the signal in travelling along a disrupted area due to microcracks that can destroy connections of the intercellular network between osteocytes and bone-lining cells. To check the potential of the proposed model to predict the damage resorption process, two bone resorption mechanoregulation rules corresponding to two mechanotransduction approaches have been implemented and tested: (1) Bone resorption based on a coupled strain-damage stimulus function without ruptured osteocyte connections (NROC); and (2) Bone resorption based on a strain stimulus function with ruptured osteocyte connections (ROC). The comparison between the results obtained by both models, shows that the proposed model based on ruptured osteocytes connections predicts realistic results in conformity with previously published findings concerning the fatigue damage repair in bone. (C) 2015 Elsevier Inc. All rights reserved.

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Publisher: ELSEVIER SCIENCE INC
Web of Science Categories: Biology; Mathematical & Computational Biology
Research Areas: Life Sciences & Biomedicine - Other Topics; Mathematical & Computational Biology
Faculty Name: Faculty of Engineering
Department Name: Production Engineering and Mechanical System Design
DSR No.: 6657
5. Analysis of adhesively bonded CFRE composite scarf joints modified with MWCNTs

Khashaba, UA (Khashaba, U. A.); Aljinaidi, AA (Aljinaidi, A. A.); Hamed, MA (Hamed, M. A.)

Abstract

The main objective of the present work is to improve the performance of bonded joints in carbon fiber composite structures through introducing Multi-Walled Carbon Nanotubes (MWCNTs) into Epocast 50-A1/946 epoxy, which was primarily developed for joining and repairing of composite aircraft structures. Results from tension characterizations of structural adhesive joints (SAJs) with different scarf angles (5-45) showed improvement up to 40% compared to neat epoxy (NE)-SAJs. Special attention was considered to investigate the performance of SAJs with 5 scarf angle under different environments. The tensile strength and stiffness of both NE-SAJs and MWCNT/E-SAJs were dramatically decreased at elevated temperature. Water absorption showed a marginal drop of about 2.0% in the tensile strength of the moist SAJs compared to the dry one. Cracks initiation and propagation were detected effectively using instrumented-SAJs with eight strain gauges. The experimental results agree well with the predicted using three-dimensional finite element analysis model. (C) 2015 Elsevier Ltd. All rights reserved.
6. Analysis of laminar film condensation over vertical permeable hollow short fins

Khaled, ARA (Khaled, A. -R. A.); Felemban, MH (Felemban, M. H.)

Abstract

Laminar falling film condensation over vertical short fin is analyzed. The fin is considered to be hollow and permeable in order to account for condensate suction towards its inner core. The present work accounts for the shear stress at the interface caused by the large velocity of the saturated vapor. The continuity, momentum, and energy equations for the film condensate are solved using an iterative and implicit finite-difference method. The condensate flow rate inside the fin is obtained using the conservation of mass principle and the Poiseuille flow equations. The one-dimensional fin equation model is used to relate the fin temperature to the condensate flow convection heat transfer coefficient. Various computational and numerical methods techniques such as advanced linearization and generations of best-fit correlations are implemented. This is to reduce significantly the number of iterations required for solution convergence as all of the aforementioned equations are coupled. It is found that the dimensionless total mass transfer rate increases slightly as vapor Reynolds number increases. It increases apparently as both suction Reynolds number and dimensionless suction length increase. For both large suction Reynolds number and large dimensionless suction length, the flow rate of the condensate in the falling film can be neglected compared to the total suction condensate flow rate. The fin thermal length increases as Reynolds number, dimensionless suction length, and Grashof number increase. This study shows that significant condensation mass flow rate enhancement ratios are obtainable (can be 18 folds) due to suction through a hollow super conductive fin.

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Web of Science Categories : Engineering, Mechanical
Research Areas : Engineering
Faculty Name : Faculty of Engineering
Department Name : Production Engineering and Mechanical System Design
DSR No. : 5337
7. Analytical model of double-lap bonded joints subjected to impact loads

Hazimeh, R (Hazimeh, Rachad); Khalil, K (Khalil, Khaled); Challita, G (Challita, Georges); Othman, R (Othman, Ramzi)

Abstract

A stress analysis of adhesively bonded double lap joints having half-infinite lengths was performed using a half-closed-form approach. The approach is based on an improved shear-lag model. Thus normal deformations and shear deformations were considered inside the adherends. Differential equations governing adherends-interfaces displacements were extracted from the dynamic equilibrium equations. Laplace transform was used to solve the differential equations. The stress variation with respect to time at the edge of the adhesive layer was investigated. Transfer function between applied load and adhesive edge shear stress was extracted. Impulse response was deduced using the inverse Laplace’s transform of the transfer function. Impulse response appeared to be a zero-order Bessel function. The indicial response of the joint can be calculated by the integration of the impulse response over time. The model was validated for different substrates’ materials. (C) 2014 Elsevier Ltd. All rights reserved.
8. Characterization and modeling of the strain rate sensitivity of polyetheretherketone's compressive yield stress

El-Qoubaa, Z (El-Qoubaa, Zakaria); Othman, R (Othman, Ramzi)

Abstract

Semi-crystalline polymers are increasingly used in structural applications where they can withstand dynamic loads. It is then, of highly importance, to measure and model their mechanical behavior over a wide range of strain rates. In this paper, the polyetheretherketone's yield stress is investigated under quasi-static (0.0001-0.1/s), intermediate (5-500/s) and high (500-10,000/s) strain rates. Four experimental set-ups were used to achieve this task. It was shown that the mechanical behavior is highly sensitive to strain rate. The yield stress at 10,000/s is 115% higher than at 0.0001/s. Moreover, the strain rate sensitivity increases with increasing strain rate. A new three-material-constant constitutive equation is proposed to take into account the increase of strain rate sensitivity at very high strain rates. An identification approach is also developed to consider the influence of the strain rate range. The material constants, of the new constitutive equation and of three constitutive equations available in the literature, are identified. For each equation, we have reported the strain rate range where each model best fits the experimental data. The new model gives the best trade-off of fitting the experimental data with a good accuracy while minimizing the number of material constants. (C) 2014 Elsevier Ltd. All rights reserved.
9. **Closed-form expressions for the effective moduli of heterogeneous piezoelectric materials**

Elouafi, J (Elouafi, J.); Azrar, L (Azrar, L.); Aljinaidi, AA (Aljinaidi, A. A.)

**Abstract**

In this paper, analytical and semi-analytical expressions for the effective properties of transversely isotropic piezoelectric materials are derived based on the Mori-Tanaka model and Eshelby tensors using compact matrix formulations. Concise explicit relations are presented for the coupled and decoupled effective electroelastic moduli of piezoelectric materials with various inclusion types and shapes. In order to use these explicit relationships, some of the Eshelby tensor components are needed to be analytically or numerically computed. These closed-form relations are suitable for use in designing composite piezoelectric materials with optimized characteristics. Results of effective electroelastic moduli, obtained using the derived closed-form expressions, are presented for various types and shapes of piezoelectric inclusions and compared with self-consistent and incremental self-consistent numerical predictions. (C) 2014 Elsevier Ltd. All rights reserved.

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<th>Sources</th>
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<td>Azrar, L (reprint author), Abdelmalek Essaadi Univ, Fac Sci &amp; Tech Tangier, Dept Math, Tangier 90000, Morocco.</td>
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<td>DSR No.</td>
<td>8382</td>
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10. Design, manufacture and analysis of composite epoxy material with embedded silicon carbide (SiC) and alumina (Al2O3) nanoparticles/fibers

Aldousari, SM (Aldousari, Saad M.); Hedia, HS (Hedia, Hassan S.); Hamed, MA (Hamed, Mostafa A.); Khashaba, UA (Khashaba, Usama A.)

Abstract

The main objective of the presented study is to improve the performance of composite structures by introducing nanoparticles/fibers in the epoxy resin. The literature on this issue showed shortcomings in the investigations of such materials. Most of the investigations in this field are to enhance the mechanical properties of epoxy materials, which cannot be used alone for high performance structural applications due to their low mechanical properties. In the present work, the epoxy resin was modified with these different types of nanofillers such as silicon carbide (SiC) and alumina (Al2O3) nanoparticles. The nanophased epoxy was used to fabricate different types of nanocomposites as well as nano-hybridized glass fiber reinforced composite laminates. Therefore, nine different advanced materials have been fabricated including two nanocomposite materials (SiC/E and Al2O3/E), two quasi-isotropic nano-hybridized composite laminates (QI-GFR/SiC/E and QI-GFR/Al2O3/E), two unidirectional nano-hybridized composite laminates (UD-GFR/SiC/E and UD-GFR/Al2O3/E), and three control panels manufactured without nanofillers (neat epoxy, QIGFR/E, UD-GFR/E). The materials were characterized under tension and compression. The results showed improvements in the tensile and compressive properties (strength and modulus) of the fabricated nanocomposites (SiC/E, and Al2O3/E) compared with neat epoxy. The hybridized composite laminate with Al2O3 showed high improvements in its mechanical properties compared to the composite laminates without nanofillers. In contrast, discouraging mechanical properties were observed for SiC hybridized composite laminate. Due to the many variables studied in the present work, the literature list will be long. The investigated parameters include nanofillers, nanocomposites, nano-hybridized advanced composite laminates, mechanical properties, glass transition temperature (T-g), bolted joint parameters and sonication parameters.
Faculty Name: Faculty of Engineering
Department Name: Production Engineering and Mechanical System Design
DSR No.: 8337
11. Direct contact membrane distillation: Capability to treat hyper-saline solution

Bouchrit, R (Bouchrit, Raja); Boubakri, A (Boubakri, Ali); Hafiane, A (Hafiane, Amor); Bouguecha, SAT (Bouguecha, Salah Al-Tahar)

Abstract

In this paper, we focused our work on the direct contact membrane distillation (DCMD) capability to treat hyper-saline solution. The governing operative model for mass transfer was investigated. The measured flux has been well predicted by the Knudsen-molecular mechanism model. The effects on the DCMD flux of polarization phenomena TP and CP were underlined. The optimum operating parameters were defined: the hot and cold stream temperatures were set, respectively at 59 and 20 degrees C, and the feed and permeate velocities were fixed both to 0.046 m s\(^{-1}\). With regard to membrane performance to treat the reverse osmosis brine, a long-term experiment was carried out under the optimal experimental conditions. The increase in feed RO brine concentration provoked a noticeably decrease in flux from 8.43 to 4.06 kg m\(^{-2}\) h\(^{-1}\). The RD brine experiments proved that the DCMD process was capable to concentrate the solution tell to reach concentration factor (CF) further than four times, which corresponded to the super-saturation of saline solution. Based on the characterization methods, the occurrence of the membrane wetting and scaling was shown and interpreted. These extreme phenomena promote the salt crystallization on the feed side of the membrane. The onset crystallization phenomenon starts when the permeate decreases so fast. Their sudden decline was about 90% for a working period of 20 h. (C) 2015 Elsevier B.V. All rights reserved.
12. Effect of Micro- to Nanosize Inclusions upon the Thermal Conductivity of Powdered Composites with High and Low Interface Resistance

Zain-ul-Abdein, M (Zain-ul-Abdein, Muhammad); Awan, WS (Awan, Waqas S.); Ijaz, H (Ijaz, Hassan); Taimoor, AA (Taimoor, Aqeel A.); Muhammad, A (Muhammad, Ayyaz); Rather, SU (Rather, Sami Ullah)

Abstract

Materials for thermal management application require better control over the thermophysical properties, which has largely been achieved by fabricating powdered composite. There are, however, several factors like filler volume fraction, shape morphology, inclusion size, and interfacial thermal resistance that limit the effective properties of the medium. This paper presents a methodology to estimate the effective thermal conductivity of powdered composites where the filler material is more conductive than the matrix. Only a few theoretical models, such as Hasselman and Johnson (HJ) model, include the effect of interfacial resistance in their formulation. Nevertheless, HJ model does not specify the nature of the interfacial thermal resistance. Although Sevostianov and Kachanov (SK) method takes care of interface thickness, they, on the other hand, have not taken into account the interfacial resistance due to atomic imperfections. In the present work, HJ model has been modified using SK method and the results were compared with experimental ones from the literature. It has been found that the effect of interfacial resistance is significant in highly resistive medium at microscale compared to nanoscale, such as Cu/diamond system, while, in a highly conductive medium, like bakelite/graphite system, the effect of shape factor is more significant than interfacial thermal resistance.

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Research Areas: Science & Technology - Other Topics; Materials Science
Faculty Name: Faculty of Engineering
Department Name: Production Engineering and Mechanical System Design
DSR No.: 7645

478
13. **Effect of process variables on the tensile shear strength of spot welds in 6061-T6 aluminum alloy**

Thiru, S (Thiru, S.); Razin, SHA (Razin, Siti Hajar Ahmad); Hema, S (Hema, S.); Mohamad, IS (Mohamad, I. S.)

**Abstract**

The changes in mechanical and metallurgical behavior of spot welded region generally occur throughout the spot welding process and these changes are very significant for the safety and quality of the welded joints. Due to the influence of current flow, the squeezing time and the load applied on electrodes have a vital effect on the mechanical properties. This paper presents the effect of such parameters on the tensile shear strength of single lap spot welded 6061-T6 aluminium alloy. Two level four factor fractional factorial design was employed to develop mathematical models. It was found that change in weld thickness and current are the primary parameters that control the tensile shear behavior of the spot welds.

**Sources**
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- Reprint Address: Thiru, S (reprint author), King Abdulaziz Univ, Dept Mech Engn, North Campus, Jeddah 21589, Saudi Arabia.
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- DSR No.: 7627
14. Effects of different models of thermal conductivity on turbulent nanofluid flow through rectangular cavity in duct

Abdellahoum, C (Abdellahoum, Chahrazed); Mataoui, A (Mataoui, Amina); Abu-Hamdeh, N (Abu-Hamdeh, Nidal); Oztop, HF (Oztop, Hakan F.)

Abstract

This article concerns the turbulent forced convection of nanofluids confined in a shallow cavity heated from all sides with a uniform temperature. This study aims to make a numerical analysis on the performance of a nanofluid composed of solid particles of alumina (Al2O3) dispersed in a base fluid (pure water) for various models of the thermal conductivity. The governing equations of the hydrodynamic flow and heat transfer are discretized by the finite volume method using a drawing power law. Numerical simulations are performed for a Reynolds number ranging from $4 \times 10^4$-$10^5$ and a volume fraction of the nanoparticles between 0 and 0.04. The obtained results show that the heat transfer is enhanced with the studied parameters for all models of thermal conductivity. (C) 2015 Elsevier B.V. All rights reserved.
15. Estimation of the mechanical properties of nanocomposites based on the properties prediction of single wall carbon nanotubes (SWCNT)

Hedia, HS (Hedia, Hassan S.); Aldousari, SM (Aldousari, Saad M.); Abdellatif, AK (Abdellatif, Ahmed K.); Abdelhaffez, GS (Abdelhaffez, Gamal S.)

Abstract

A finite element model has been developed based on molecular mechanics to predict the mechanical properties of single wall carbon nanotubes (SWCNT). In addition, the mechanical properties of nanocomposite were investigated analytically and experimentally. This work consists of three parts; the first part is prediction of Young's modulus of single wall carbon nanotubes by molecular mechanics based finite element modeling. The second part describes the experimental work. The third part deals with the validation of the analytical part and the experimental work. The mechanical properties of SWCNT were obtained from FE. The mechanical properties of neat epoxy were experimentally determined. Both of them were used to estimate the mechanical properties of SWCNT/epoxy nanocomposite analytically. A comparison between the analytical and experimental results of SWCNT/epoxy nanocomposite has been done. The modeling and analysis of (SWCNT) were carried out using FEM by MATLAB and ANSYS software. However, in the experimental work the epoxy resin was modified by adding SWCNT with different ratio, i.e. 0, 0.1, 0.3, 0.5 and 0.7 wt.-%, respectively. The materials were characterized in tension to obtain the mechanical properties of SWCNT/epoxy nanocomposite experimentally. The results from the FE model were compared with the results in the literature and good agreement was achieved. The FE approach is a valuable tool for studying the mechanical behavior of carbon nanotubes. The results show that a nanotube weight percent of 0.3 wt.-% of SWCNT improves all mechanical properties such as tensile strength, modulus of elasticity and toughness. The weight percent greater than 0.5 wt.-% SWCNT should be avoided. To predict the mechanical properties of the composite materials analytically, it is worth considering the conventional rule of mixtures using the reasonable nanotube volume fractions and exact value of the efficiency parameter.

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Publisher : CARL HANSSER VERLAG
Web of Science Categories : Materials Science, Characterization & Testing
Research Areas: Materials Science
Faculty Name: Faculty of Engineering
Department Name: Production Engineering and Mechanical System Design
DSR No.: 6359
16. Experimental investigation of quasi-static and intermediate strain rate behaviour of polypropylene glass fibre (PPGF) woven composite

Martin, A (Martin, A.); Othman, R (Othman, R.); Rozycki, P (Rozycki, P.)

Abstract

This article covers an in plane experimental characterisation of a polypropylene glass fibre reinforced woven composite. Tensile, shear and compression loadings were carried out with a standard tensile rig and a crossbow/Hopkinson pressure bar rig. The specimen strain was measured by digital image correlation technique. It is concluded that the composite stiffness and strength are highly sensitive to strain rate. Static and dynamic multicycle tests were also undertaken to identify and quantify softening phenomenon. Thus, permanent plastic strain and reduction in stiffness are observed and quantified.
17. Experimental investigation of the influence of substrates' fibers orientations on the impact response of composite double-lap joints

Hazimeh, R (Hazimeh, Rachad); Challita, G (Challita, Georges); Khalil, K (Khalil, Khaled); Othman, R (Othman, Ramzi)

Abstract

The main concern of this work is the mechanical characterization of the double-lap composite bonded assemblies under impact shear loads. The assemblies were made of unidirectional PEEK! Carbon composites and a brittle epoxy adhesive. The impact shear strength and failure strain were measured experimentally by the Split Hopkinson Pressure Bar apparatus, taking into account the set-up accuracy correction by finite element methods. The composite joints shear strength and strain at failure are sensitive to the loading rate and the substrates' fibers orientation. The highest shear strength is recorded when the substrates fibers are oriented in the same direction as the impact loading. Moreover, the lowest shear strength is observed when the substrates fibers are oriented perpendicular to the impact loading. However, the loading rate and the substrates fibers orientation have opposite effects on the shear strain at failure. (C) 2015 Elsevier Ltd. All rights reserved.
Facile preparation of BiVO4 nanoparticle film by electrostatic spray pyrolysis for photoelectrochemical water splitting
Liu, X (Liu, Xu); Liu, Y (Liu, Ya); Su, JZ (Su, Jinzhan); Li, MT (Li, Mingtao); Guo, LJ (Guo, Liejin)

Abstract

Bismuth vanadate has a band structure that is well-suited for potential use as a photoanode in solar water splitting. Here we describe the successful fabrication of a densely uniform BiVO4 nanoparticle film on fluorine-doped tin oxide coated glass based on an electrostatic spray pyrolysis process. The deposition temperature and the mole ratio of Bi/V were controlled to find the optimal preparation condition. The optimized thin film has a monoclinic crystal structure, and the diameter of the nanoparticles is about 20-80 nm. Under simulated AM 1.5G illumination, the best performing photocurrent density can reach to 0.8 mA/cm(2) at an applied potential of 1.9 V versus RHE while the corresponding average incident photon to current conversion efficiency within the absorption range is similar to 5%. Besides, the synthesis details discussed in this work can provide a generic route for preparing other binary oxide films. Copyright (C) 2015, Hydrogen Energy Publications, LLC. Published by Elsevier Ltd. All rights reserved.
19. Finite element analysis of adhesively bonded composite joints subjected to impact loadings

Hazimeh, R (Hazimeh, R.); Challita, G (Challita, G.); Khalil, K (Khalil, K.); Othman, R (Othman, R.)

Abstract

The main concern of this paper is to explore the geometrical and material effects on composite double lap joints (DLJ) subjected to dynamic in-plane loadings. Thus, three-dimensional finite element analyses were carried out at quasi-static and impact velocities. The DLJ alone was used for quasi-static case while an output bar was added for impact case. Elastic behavior was assumed for both adhesive and adherends. Average shear stress and stress homogeneity were extracted and compared. It was observed that the adhesive shear stiffness increases the average shear stress. Moreover, it makes the stress heterogeneity more important. On the other hand, higher values of the substrates longitudinal stiffness make the average shear stress higher; whereas, the stress homogeneity in the joint is better achieved for lower substrates' shear stiffness. (C) 2014 Published by Elsevier Ltd.
20. Hybrid CO2 laser/waterjet (CO2-LWJ) cutting of Polycrystalline Cubic Boron Nitride (PCBN) blanks with phase transformation induced fracture

Wu, ZR (Wu, Zhuoru); Melaibari, AA (Melaibari, Ammar A.); Molian, P (Molian, Pal); Shrotriya, P (Shrotriya, Pranav)

Abstract

The present paper investigates a transformation induced fracture mechanism for the cutting of Polycrystalline Cubic Boron Nitride (PCBN) sample by a hybrid CO2 laser/waterjet (CO2-LWJ) manufacturing process. In CO2-LWJ machining, a laser was used for local heating followed by waterjet quenching leading to fracture propagation along the sample surface. Cutting results indicate that as line energy of the laser was increased the sample response transitioned from scribing to through cutting. Raman spectroscopy analysis of the cut surface indicates that laser heated PCBN undergoes chemical phase transformation from sp(3)-bonded cubic Boron Nitride (cBN) into hexagonal Boron Nitride (hBN) and other sp(2)-bonded phases. The sp(2)-bonded structure occupies more volume than sp(3)-bonded structure such that the transformed material has a tendency to expand the original material and leads to surface deformation around the cutting path. Surface profile of the cut samples was experimentally measured using profilometry and compared with numerical predictions in order to estimate the expansion strain and dimensions of transformation region. Based on the obtained expansion strain and transformation zone, stress fields and crack driving forces were computed for channeling cracks that result in material separation. Comparison of the crack driving forces with fracture toughness of PCBN shows that transformation induced crack propagation is the feasible mechanism for cutting during CO2-LWJ machining. (C) 2015 Elsevier Ltd. All rights reserved.
21. **Impact of the Surface Morphology on the Combustion of Simulated Solid Rocket Motor**

Hegab, AM (Hegab, Abdelkarim M.); Sait, HH (Sait, Hani Hussain); Hussain, A (Hussain, Ahmad)

**Abstract**

An advanced and intensive computational solution development is integrated with an asymptotic technique, to examine the impact of the combustion surface morphology on the generated rotational flow field in a solid rocket chamber with wide ranges of forcing frequencies. The simulated rectangular chamber is closed at one end and is open at the aft end. The upper and lower walls are permeable to allow steady and unsteady injected air to generate internal flow mimicking the flow field of the combustion gases in real rocket chamber. The frequencies of the unsteady injected flow are chosen to be very close or away from the resonance frequencies of the adapted chamber. The current study accounts for a wide range of wave numbers that reflect the complexity of real burning processes. Detailed derivation for Navier-Stokes equations at the four boundaries of the chamber is introduced in the current study. Qualitative comparison is performed with recent experimental work carried out on a two-inch hybrid rocket motor using a mixture of polyethylene and aluminum powder. The higher the percentage of aluminum powder in the mixture, the more the corrugations of the combustion surface. This trend is almost similar to the computational and analytical results of a simulated solid rocket chamber.

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MATHEMATICAL PROBLEMS IN ENGINEERING


29 English Review

Hussain, A (reprint author), King Abdulaziz Univ, Dept Nucl Engn, POB 80204, Jeddah 21589, Saudi Arabia.

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Engineering; Mathematics

Faculty of Engineering

Production Engineering and Mechanical System Design

8230
22. Improve the performance of coated cemented hip stem through the advanced composite materials

Hedia, HS (Hedia, H. S.); Fouda, N (Fouda, N.)

Abstract

Design of hip joint implant using functionally graded material (FGM) (advanced composite material) has been used before through few researches. It gives great results regarding the stress distribution along the implant and bone interfaces. However, coating of orthopaedic implants has been widely investigated through many researches. The effect of using advanced composite stem material, which mean by functionally graded stem material, in the total hip replacement coated with the most common coated materials has not been studied yet. Therefore, this study investigates the effect of utilizing these two concepts together; FGM and coating, in designing new stem material. It is concluded that the optimal FGM cemented stem is consisting from titanium at the upper stem layers graded to collagen at a lower stem layers. This optimal graded stem coated with hydroxyapatite found to reduce stress shielding by 57% compared to homogenous titanium stem coated with hydroxyapatite. However, the optimal functionally graded stem coated with collagen reduced the stress shielding by 51% compared to homogenous titanium stem coated with collagen.
Influence of Dissimilar Adherends on the Stress Distribution in Adhesively Bonded Composite Joints Subjected to Impact Loadings

Hazimeh, R (Hazimeh, R.); Challita, G (Challita, G.); Khalil, K (Khalil, K.); Othman, R (Othman, R.)

Abstract

The influence of nonsymmetric rotation of laminates on the shear and peel stresses in the adhesive layer of adhesively bonded double-lap composite joints (DLJ) subjected to in-plane impact compressive loadings is investigated by using a three-dimensional finite-element analysis. The compressive in-plane impact on DLJ is simulated using the direct Hopkinson bar system, and the specimen is impacted by an incident bar. It is found that the rotation of any adherend from the 0A degrees orientation leads to a decrease in the average shear stress in the adhesive layer, but the maximum peel stress is affected only by the longitudinal stiffness of the outer adherend and decreases when this stiffness diminishes.
24. Investigation of heat transfer enhancement inside developing gravity-driven films along a vertical permeable plate subject to nonuniform suction

Khaled, ARA (Khaled, Abdul-Rahim A.)

Abstract

Flow and heat transfer through the boundary layers of a falling liquid film on a vertical permeable plate subject to nonuniform suction flow are analyzed in this work. The continuity, momentum, and energy equations are transformed to nonsimilar equations and solved using a validated implicit and iterative finite difference method. Increases in the Froude number, Galilei number, and the dimensionless average suction velocity are found to increase the skin friction coefficient, the Nusselt number, and the heat transfer enhancement ratios. These enhancement ratios are noticed to increase at the plate exit as the suction velocity power-law index increases. The Froude number for uniform suction case required to attain the same enhancement ratios due to nonuniform distribution of this suction flow is found to increase as the Galilei number, average suction velocity, and power-law index increase. It is found that the upper most values of the enhancement factors in heat transfer and Froude number are \( m + 1 \) folds when the suction power-law index is equal to \( m \). This work demonstrated that significant heat transfer enhancement inside developing gravity-driven liquid films is attainable when properly distributing the suction velocity along the plate.

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DSR No.: 5822
25. Large Eddy Simulation of Flow Past Tandem Cylinders in a Channel

AlQadi, I (AlQadi, Ibraheem); AlHazmy, M (AlHazmy, Majed); Al-Bahi, A (Al-Bahi, Ali); Rodi, W (Rodi, Wolfgang)

Abstract

The paper presents Large Eddy Simulation (LES) of flow around two circular cylinders in tandem placed in an open channel. This and the closely related situation of tandem cylinders in a passage are rich of complex flow phenomena and of considerable practical and fundamental interest. The configuration was set up to correspond closely to an experiment (Ataie-Ashtiani and Aslani-Kordkandi Flow Turbul. Combust. 90(3), 471-490 (2013)) with detailed velocity measurements. The ratio of the distance between the cylinders, \( L \), and the cylinder diameter, \( D \), and the ratio of water depth \( h \) to \( D \), are \( L/D=3 \) and \( h/D=3.1 \), respectively, as in the experiment. However, a lower Reynolds number had to be used and a smooth channel wall instead of a somewhat rough wall in the experiments. The Reynolds numbers based on channel height and cylinder diameter are 22,600 and 7,300 respectively. A fine grid was employed so that the LES is well resolved and the results are little affected by the subgrid-scale model (dynamic Smagorinsky) and represent well the actual physical processes of the situation studied. A comparison with experimental results of mean flow, turbulence quantities and shedding frequency shows that there is good agreement about all the main features, but there are some quantitative differences as the flow situations differed in some respects. The complex 3D flow behaviour is analyzed and described with the aid of the LES results, and these also provide benchmark data for testing other, less costly calculation methods which are preferred in practice.

Khaled, ARA (Khaled, A.-R. A.)

Abstract

Heat transfer enhancement in permeable tubes subjected to transverse suction flow is investigated in this work. Both momentum and energy equations are solved analytically and numerically. Both solutions based on negligible entry regions are well matched. Two different suction velocity distributions are considered. A parametric study including the influence of the average suction velocity and the suction velocity profile is conducted for various Peclet numbers. It is found that enhancement of heat transfer over that in impermeable tubes is only possible with large Peclet numbers. This enhancement increases as suction velocities towards the tube outlet increase and as those towards the tube inlet decrease simultaneously. The identified enhancement mechanisms are expanding the entry regions, increasing the transverse advection, and increasing the downstream excess temperatures under same transverse advection. The average suction velocity that produces maximum enhancement increases as the Peclet number increases until it reaches asymptotically its uppermost value at large Peclet numbers. The maximum reported enhancement ratios for the exponential and linear suction velocity distributions are 17.62-fold and 14.67-fold above those for impermeable tubes, respectively. This work demonstrates that significant heat transfer enhancement is attainable when the suction flow inside the permeable tubes is distributed properly.
27. Mechanical Properties and Gradient Effects of Carbon Nanotube as Polymer Nanocomposites

Abu-Hamdeh, N (Abu-Hamdeh, N.); Alnefaie, K (Alnefaie, K.)

Abstract

Carbon nanotubes (CNTs) were fabricated using low pressure chemical vapor deposition (LPCVD) and then embedded in epoxy polymer at several weight ratios; 0, 0.75, 1.5, and 3 (wt %) for tensile testing and Young's modulus determination using intron machine. Tensile strength and Young's modulus of the epoxy resin were increased with the addition of CNTs to a certain extend and then decreased with the increase in weight fraction of carbon nanotubes. The best properties occurred at 1.5 (wt %) of CNTs. Scanning electron microscopy was used to reveal the dispersion status of carbon nanotubes in the nanocomposites.

Sources

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Research Areas : Computer Science
Faculty Name : Faculty of Engineering
Department Name: : Production Engineering and Mechanical System Design
DSR No. : 7808
Microwave dielectric characterization of Saudi Arabian date palm biomass during pyrolysis and at industrial frequencies

Sait, HH (Sait, Hani H.); Salema, AA (Salema, Arshad Adam)

Abstract

The knowledge of the dielectric property is essential to design and develop microwave technology for processing biomass materials. This paper focuses on the measurement of dielectric properties of three different Saudi Arabian date palm biomass (seed, leaf and stem) from room temperature to similar to 800 degrees C and at six different frequencies (397-2986 MHz) using a cavity perturbation method. The result showed that all date palm biomass samples were poor microwave absorbers from room temperature till 500 degrees C. The dielectric constant and loss factor dropped slightly in the drying region due to removal of moisture and was almost constant in pyrolysis region. However, a significant increase in dielectric constant and loss factor occurred in temperature between 500 and 750 degrees C, except for leaf biomass. Penetration depth and tangent loss had an opposite behavior with the rise in temperature. In conclusion, the dielectric properties might not only depend on the temperature and frequency but also on the physical and chemical characteristics of the biomass material. For instance, it was interesting to know that date leaf showed a sharp decrease in loss factor from temperature 475 degrees C, which was opposite to that observed in case of date seed and stem. The data can be very useful in designing, modeling and simulation of microwave processing system for date palm biomass. (C) 2015 Elsevier Ltd. All rights reserved.
29. Nitrate removal from aqueous solution by direct contact membrane distillation using two different commercial membranes

Boubakri, A (Boubakri, Ali); Hafiane, A (Hafiane, Amor); Bouguecha, SA (Bouguecha, Salah Al Tahar)

Abstract

In the present work, the removal of nitrate from aqueous solution by direct contact membrane distillation (DCMD) using flat sheets polypropylene (PP) and polyvinylidene fluoride (PVDF) membranes was studied. Effect of operating parameters, such as feed temperature, feed flow rate, initial nitrate concentration, feed ionic strength, and competing co-existing anions on permeate flux and nitrate rejection, was investigated. In all DCMD experimental runs, an almost complete nitrate rejection was achieved (higher than 99.90%) and the permeate nitrate concentration was largely below the maximum permissible level in potable water. Under the same operating conditions, PVDF hydrophobic membrane showed a higher permeate flux of 37.21L/m(2)h than PP membrane with a permeate flux of 4.12L/m(2)h. For both the membranes, feed temperature is the important operating parameter which enhanced exponentially the permeate flux. Likewise, a positive effect on permeate flux was found when feed flow rate was increased. However, no significant effect was found by varying initial nitrate concentration, feed ionic strength, and the presence of co-existing anions on DCMD permeate flux or nitrate rejection efficiency.

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- Faculty Name: Faculty of Engineering
- Department Name: Production Engineering and Mechanical System Design
- DSR No.: 4251
30. **Numerical modeling of dynamic and parametric instabilities of single-walled carbon nanotubes conveying pulsating and viscous fluid**

Azrar, A (Azrar, A.); Azrar, L (Azrar, L.); Aljinaidi, AA (Aljinaidi, A. A.)

**Abstract**

The dynamic and parametric instabilities of single-walled carbon nanotubes (CNTs) conveying pulsating and viscous fluid embedded in an elastic medium are modeled and numerically investigated. The partial differential equation of motion based on the nonlocal elasticity theory, Euler Bernoulli beam's model and fluid tube interaction is given. Based on the differential quadrature method, complex eigenmodes and associated eigenfrequencies are investigated with respect to the flow velocity as well as to the other considered physical parameters. Multimodal formulation based on real and complex eigenmodes are presented in the frequency and time domains. Models are elaborated for dynamic instabilities such as divergence and flutter as well as for parametric instability behaviors. The influences of the nonlocal parameter, the fluid pulsation and viscosity, the viscoelastic CNT parameter and the thermal effects on the dynamic behaviors of the CNT-fluid system are analyzed. Instability boundaries and interaction between the dynamic and parametric instabilities are investigated. (C) 2015 Elsevier Ltd. All rights reserved.

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Numerical simulation of brackish water desalination by a reverse osmosis membrane

Anqi, AE; Alkhamis, N; Oztekin, A

Abstract

The brackish water desalination by reverse osmosis membranes has been widely used to purify water. This study focuses on how the momentum mixing in the feed flow affects the membrane performance. Steady and transient two dimensional flows in a channel containing circular shaped spacers are investigated. Different arrangements and the spacing of cylinders are considered for the Reynolds number of 400, 800, and 4000. The feed channel is bounded by membranes. The velocity, the pressure, and the concentration fields are obtained by solving the Navier-Stokes and the mass transport equations. Laminar and turbulent flow models are employed in this study. The Shear Stress Transport (SST) k-omega turbulence model is utilized when the flow is turbulent. The membrane is treated as a permeable wall, and it is modeled as a functional surface. The water permeate is calculated based on the local osmotic pressure and the concentration at the membrane surface. Momentum mixing promoted by spacers enhances the membrane performance significantly. (C) 2015 Elsevier B.V. All rights reserved.
32.  **Numerical simulation of the temperature rise in intermediate and high strain rate experiments**

Baselem, M (Baselem, Majed); Othman, R (Othman, Ramzi); Chamekh, A (Chamekh, Abdessalem)

**Abstract**

Intermediate and high strain rate experiments are of a limited duration. Thus, the specimen temperature cannot be assumed constant. In this work, we investigated the adiabatic assumption in intermediate and high strain experiments. A two-step one-dimensional model was developed to simulate the temperature rise in Hopkinson bar experiments for strain rates ranging between 1 and 5000/s. The model is applied to predict temperature rise in an aluminum alloy. The adiabatic assumption is shown to be valid for strain rates higher than 500/s. However, the isothermal assumption is not valid even at 1/s of strain rate. These conclusions are very important for the interpretation of the stress-strain curves that are measured at medium and high strain rates.

**Sources**
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33. Numerical study of gas separation using a membrane

Alkhamis, N (Alkhamis, Nawaf); Oztekin, DE (Oztekin, Dennis E.); Anqi, AE (Anqi, Ali E.); Alsaiari, A (Alsaiari, Abdulmohsen); Oztekin, A (Oztekin, Alparslan)

Abstract

Computational fluid dynamics simulations are conducted for multicomponent fluid flows in a channel containing spacers. A new and unique model has been presented for the treatment of the membrane boundaries in the separation CO2 from CH4 in a binary mixture. The equation governing the flux through the membrane is derived from first principles. The membrane is modeled as a functional surface, where the mass fluxes of each species will be determined based on the local partial pressures, the permeability, and the selectivity of the membrane. The approach introduced here is essential for simulating gas-gas separation. Baseline Reynolds stress, k-omega BSL, and large eddy simulation, LES, turbulence models are employed to study spatial and temporal characteristics of the flow for Reynolds number up to 1000. It is shown here that the spacers have a strong effect on the membrane performance. The process of separating CO2 from CH4 is improved by the presence of spacers in the membrane system. It is demonstrated that spacers should be an integral part of the membrane system design in the application of gas-gas separation. (C) 2014 Elsevier Ltd. All rights reserved.
**34. On the Effect of Strain Gradient on Adiabatic Shear Banding**

Tsagrakis, I (Tsagrakis, Ioannis); Aifantis, EC (Aifantis, Elias C.)

**Abstract**

Most of the work on adiabatic shear banding is based on the effect of temperature gradients on shear band nucleation and evolution. In contrast, the present work considers the coupling between temperature and strain gradients. The competition of thermal and strain gradient terms on the onset of instability and its dependence on specimen size is illustrated. It is shown that heat conduction promotes the instability initiation in the hardening part of the homogeneous stress-strain, while the strain gradient term favors the occurrence of this initiation in the softening regime. This behavior is size dependent, i.e., small specimens can support stable homogeneous deformations even in the softening regime. The spacing of adiabatic shear bands is also evaluated by considering the dominant instability mode during the primary stages of the localization process and it is found that it is an increasing function of the strain gradient coefficient.
35. Optimal design of integrated CHP systems for housing complexes

Fuentes-Cortes, LF (Fabian Fuentes-Cortes, Luis); Ponce-Ortega, JM (Maria Ponce-Ortega, Jose); Napoles-Rivera, F (Napoles-Rivera, Fabricio); Serna-Gonzalez, M (Serna-Gonzalez, Medardo); El-Halwagi, MM (El-Halwagi, Mahmoud M.)

Abstract

This paper presents a multi-objective optimization approach for designing residential cogeneration systems based on a new superstructure that allows satisfying the demands of hot water and electricity at the minimum cost and the minimum environmental impact. The optimization involves the selection of technologies, size of required units and operating modes of equipment. Two residential complexes in different cities of the State of Michoacan in Mexico were considered as case studies. One is located on the west coast and the other one is in the mountainous area. The results show that the implementation of the proposed optimization method yields significant economic and environmental benefits due to the simultaneous reduction in the total annual cost and overall greenhouse gas emissions. (C) 2015 Elsevier Ltd. All rights reserved.
Peristalsis in a curved channel with slip condition and radial magnetic field

Shehzad, SA (Shehzad, S. A.); Abbasi, FM (Abbasi, F. M.); Hayat, T (Hayat, T.); Alsaadi, F (Alsaadi, F.); Mousa, G (Mousa, G.)

Abstract

Impact of radially varying applied magnetic field on the peristaltic transport of a Carreau-Yasuda (CY) fluid through a curved channel is examined. Analysis is performed when the no-slip condition does not hold. Long wavelength and low Reynolds number approximations are taken into consideration in the mathematical formulation of the problem. Both differential equation and boundary condition are nonlinear. Resulting nonlinear equation subject to the nonlinear boundary conditions are numerically solved with Runge-Kutta fourth order with numerical Shooting. Impacts of sundry parameters on the quantities of interest are analyzed through plots. Results show that plots of the axial velocity are not symmetric about the center line for flow through curved conduits. Consequently the fluid flowing through a curved channel exerts additional stress on the inner wall of the curved channel. Such symmetry is restored when we move from curved to straight channel. Maximum fluid velocity decreases with an increase in the strength of applied magnetic field and the velocity slip parameter. Further the stress at the inner wall reduces by increasing the value of curvature parameter. (C) 2015 Elsevier Ltd. All rights reserved.
37. Prediction of the elastic modulus of SWCNT/epoxy composite based on the micromechanics

Hedia, HS (Hedia, Hassan S.); Aldousari, SM (Aldousari, Saad M.); Abdellatif, AK (Abdellatif, Ahmed K.); Abdelhafeez, GS (Abdelhafeez, Gamal S.)

Abstract

Due to their superior mechanical and physical properties, carbon nanotubes seem to hold a great promise as an ideal reinforcing material for composites of high strength and low density. In most of the experimental results up to date, however, only modest improvements in the strength and stiffness have been achieved by incorporating carbon nanotubes in polymers. In the present paper, the stiffening effect of carbon nanotubes is quantitatively investigated by micromechanics methods. The Mori-Tanaka effective field method has been adopted to calculate the effective elastic moduli of composites with aligned or randomly oriented straight nanotubes. The rule-of-mixtures is used to calculate the modulus of elasticity for nanocomposite. The results of micromechanics methods indicated that the CNTs are highly anisotropic, with Young's modulus in the tube direction two orders of magnitude higher than that normal to the tube. The results of micromechanics methods were compared by those obtained from the rule-of-mixtures and good agreement was also achieved when the efficiency parameter empty set = 1 and typical results were achieved with empty set = 0.25. To predict the mechanical properties of the composite materials, it is worth considering the conventional rule-of-mixtures using exact value of the efficiency parameter empty set. To predict the elastic modulus of nanocomposite reinforced by SWCNT using the conventional rule-of-mixtures, the exact value of the efficiency parameter empty set is equal to 0.25 when using nanotubes with chirality (8,3) for determination the elastic modulus of SWCNT. However, for zigzag orientation and chirality (8,0) the efficiency parameter empty set is equal to 1. The conventional rule-of-mixtures is a powerful tool and easy method compared to the micromechanics methods.
Size effects on magnetoelectric response of multiferroic composite with inhomogeneities

Yue, YM (Yue, Y. M.); Xu, KY (Xu, K. Y.); Chen, T (Chen, T.); Aifantis, EC (Aifantis, E. C.)

Abstract

This paper investigates the influence of size effects on the magnetoelectric performance of multiferroic composite with inhomogeneities. Based on a simple model of gradient elasticity for multiferroic materials, the governing equations and boundary conditions are obtained from an energy variational principle. The general formulation is applied to consider an anti-plane problem of multiferroic composites with inhomogeneities. This problem is solved analytically and the effective magnetoelectric coefficient is obtained. The influence of the internal length (grain size or particle size) on the effective magnetoelectric coefficients of piezoelectric-piezomagnetic nanoscale fibrous composite is numerically evaluated and analyzed. The results suggest that with the increase of the internal length of piezoelectric matrix (PZT and BaTiO3), the magnetoelectric coefficient increases, but the rate of increase is ratcheting downwards. If the internal length of piezoelectric matrix remains unchanged, the magnetoelectric coefficient will decrease with the increase of internal length scale of piezomagnetic nonfiber (CoFe2O3). In a composite consisting of a piezomagnetic matrix (CoFe2O3) reinforced with piezoelectric nanofibers (BaTiO3), an increase of the internal length in the piezomagnetic matrix, results to a decrease of the magnetoelectric coefficient, with the rate of decrease diminishing. (C) 2015 Elsevier By. All rights reserved.
39. State space approach for the vibration of nanobeams based on the nonlocal thermoelasticity theory without energy dissipation

Zenkour, AM (Zenkour, A. M.); Abouelregal, AE (Abouelregal, A. E.); Alnefaie, KA (Alnefaie, K. A.); Abu-Hamdeh, NH (Abu-Hamdeh, N. H.); Aljinaidi, AA (Aljinaidi, A. A.); Aifantis, EC (Aifantis, E. C.)

Abstract

In this article, an Euler-Bernoulli beam model based upon nonlocal thermoelasticity theory without energy dissipation is used to study the vibration of a nanobeam subjected to ramp-type heating. Classical continuum theory is inherently size independent, while nonlocal elasticity exhibits size dependence. Among other things, this leads to a new expression for the effective nonlocal bending moment as contrasted to its classical counterpart. The thermal problem is addressed in the context of the Green-Naghdi (GN) theory of heat transport without energy dissipation. The governing partial differential equations are solved in the Laplace transform domain by the state space approach of modern control theory. Inverse of Laplace transforms are computed numerically using Fourier expansion techniques. The effects of nonlocality and ramping time parameters on the lateral vibration, temperature, displacement and bending moment are discussed.
40. Stepwise varying width microchannel cooling device for uniform wall temperature: Experimental and numerical study

Riera, S (Riera, Sara); Barrau, J (Barrau, Jerome); Omri, M (Omri, Mohamed); Frechette, LG (Frechette, Luc G.); Rosell, JI (Rosell, Joan I.)

Abstract

Within the high heat extraction cooling technologies, stepwise varying width microchannel cooling schemes have demonstrated their capacity to provide high temperature uniformities with low pressure drops. In this study, a method to tailor the design of this kind of cooling device to the needs on an application is developed. The resulting geometry is experimentally tested. A global thermal resistance coefficient of $2.35 \times 10^{-5}$ m$^2$ K/W has been found, improving near three-fold the performance in a millimetrical scale for the same flow rate. The temperature profile of the wall temperature is quite uniform, validating the design of the cooling device. A numerical model is developed and validated through comparison with experimental results. It shows the smoothing effect of the Thermal Interface Material (TIM) on the temperature profile and the improvement of both the thermal resistance coefficient and the temperature uniformity with the increase of the flow velocity. (C) 2014 Elsevier Ltd. All rights reserved.
41. Tensile Behavior of Polyetheretherketone over a Wide Range of Strain Rates

El-Qoubaa, Z (El-Qoubaa, Zakaria); Othman, R (Othman, Ramzi)

Abstract

Polyetheretherketone (PEEK) is used in several engineering applications where it has to bear impact loads. Nevertheless, the tensile behavior has only been studied in the quasi-static range of loading rates. To address the lack of data in the impact strain rate range, the tensile mechanical behavior of PEEK is investigated at room temperature over a large range of strain rates (from 0.001 to 1000/s). The macroscopic volume change is studied under uniaxial tension using digital image correlation (DIC) method, showing a significant dilatation that reaches 16% at a logarithmic axial strain of 40%. The true stress-strain behavior is therefore established based on the measured volume change. Elsewhere, the yield stress shows a significant sensitivity to strain rate. Besides, a new constitutive equation is proposed to take into account the increase in strain rate sensitivity at high strain rates. It assumes an apparent activation volume which decreases as the strain rate increases. The new constitutive equation gives similar results when compared to the Ree-Eyring equation. However, only three material constants are to be identified and are physically interpreted.
42. Thermal performance of six different types of wavy-fins
Khaled, ARA (Khaled, Abdul Rahim Assaad)

Abstract

Purpose - Heat transfer inside wavy fins is analyzed in this work. The paper aim to discuss this issue. Design/methodology/approach - Six different types of wavy fins are considered. The fin equation for each fin type is solved using a high accurate finite difference method. Excellent agreement is obtained between the numerical solution under zero wave amplitude and the exact solution of the plain fin. Findings - The following wavy fin types and conditions are found to produce larger heat transfer rate and its volumetric value than those for the plain fin and other wavy fins: short fins with parallel wavy profiles and large surface-wave frequency; long fins with symmetric wavy surface around the length axis, positive cross-sectional area gradient at the base, and large surface-wave frequency; and long fins with symmetric wavy profiles around the length axis, positive cross-sectional area gradient at the base, and small surface-wave frequency. Research limitations/implications - In addition, both fins with symmetric wavy surface around the width axis and parallel wavy surfaces along the width axis have same performance indicators. Also, these wavy fins possess higher fin efficiency than either that of the plain fin or those of the other types of wavy fins. Originality/value - Finally, heat transfer enhancements in the studied wavy fins are increased by increases in the excess of the surface area, cross-sectional area gradient at the base, arc length and arc width relative to those of the plain fin.

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Thermal properties and heat transfer study of dispersed fluid with functionalized Multi-Walled Carbon Nanotube (MWCNT) particles

Zahari, FN (Zahari, F. N.); Salim, MRHN (Salim, M. R. H. Noor); Mohamad, IS (Mohamad, I. S.); Abdullah, N (Abdullah, N.); Thiru, S (Thiru, S.)

Abstract

Water, ethylene glycol and engine oil are commonly used in heat exchanger applications as coolant. However, these fluids possess low thermal conductivity. The advancement in nanotechnology has enabled nano-size particles to be included in a base fluid and this is known as nanofluids. The aim of this study is to investigate the most stable and homogeneous nanofluids with different weight percentage that produced excellent result in thermal properties and heat transfer characteristics. For this study, the usage of MWCNT as nanoparticles and deionized water as based fluids with surfactant were investigated for their stability and thermal properties. Different temperature and particle volume concentration were used in this study and this will affect the thermal conductivity, viscosity and specific heat as well as the heat transfer characteristics of nanofluids. As a result, the thermal conductivity and specific heat capacity of nanofluids were increased when the temperature and particle volume concentration increased. Besides that, the viscosity of nanofluids seem to decreased when temperature was increased but not for its particle concentration.

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44. Toughness, flexural, damping and interfacial properties of hybridized GFRE composites with MWCNTs

Khashaba, UA (Khashaba, U. A.)

Abstract

As the improved damping in fiber-reinforced composites can affect the other mechanical properties, therefore, the aim of this work is to investigate the effect of multiwall carbon nanotube (MWCNT) on the interfacial bond strength, flexural strength and stiffness, toughness and damping properties of hybridized glass-fiber reinforced epoxy (GFRE) composites. Nanophased epoxy resin was used to hybridize unidirectional and quasi-isotropic GFRE composites with [0/+/− 45/90](s), and [90/+/− 45/0](s) stacking sequences. Results from the interfacial characterizations of the hybridized composites showed improvement up to 30% compared to the control laminates. Hybridization of GFRE laminates with MWCNTs leads to decreasing the flexural and storage moduli, increasing flexural strength, toughness, natural frequencies and damping ratio. A high correlation coefficient of 0.9985 was obtained between static flexural and dynamic storage moduli. The highest flexural strength, flexural and storage moduli and natural frequency of quasi-isotropic laminate were observed for [0/+/− 45/90](s), stacking sequence and vice versa for damping ratio. (C) 2014 Elsevier Ltd. All rights reserved.
DEPARTMENT OF
THERMAL ENGINEERING AND DESALINATION
TECHNOLOGY
1. Numerical study on biomass model compound gasification in a supercritical water fluidized bed reactor

Su, XH (Su, Xiaohui); Jin, H (Jin, Hui); Guo, SM (Guo, Simao); Guo, LJ (Guo, Liejin)

Abstract

Supercritical water fluidized bed gasifier is a new promising reactor for thermochemical conversion of wet biomass. However, there exists many troubles in directly measuring the process details in the reactor due to the extreme operating condition. A comprehensive 3-D numerical model of hydrodynamics based on the two-fluid model accompanying with heat transfer and chemical reactions kinetics is developed in this study to simulate glucose gasification in a supercritical water fluidized bed reactor in a temperature range 823-923 K under pressure 25 MPa. The particle collision is described by the kinetic theory of granular flow. The gasification reaction rates are determined by Arrhenius equation. The flow behavior of supercritical water-particle flow, temperature and reaction rates distribution, gas composition profiles in the bed were predicted and assessed against available published experimental data. The particles show a homogeneous fluidization in supercritical water fluidized bed. Results show that the current three dimensional gasification model can reasonably describe the reacting flow behavior in the supercritical water fluidized bed reactor, which may provide a convenient and low-cost way for the reactor design and optimization. (C) 2015 Elsevier Ltd. All rights reserved.