King Fahd University of Petroleum & Minerals

Deanship of Graduate Studies

Sunday, Feb 12, 2012

6th GRADUATES' SEMINAR DAY

Book of Abstracts

6th Graduate Seminar Day Organizing Committee:

- Ali Muqaibel (Chairman)
- Abdel-Salam Eleiche
- Mohamed Abu-Sbeih
- Basim Abussaud
- Mourad Mansour
- Mohammad Hassanain
- Mahmoud Elish
- Abdullah Alshuhail

Introduction

This Graduate Seminar Day is a continuation of the annual seminar series initiated by the Deanship of Graduate Studies at King Fahd University of Petroleum & Minerals in 2007. The idea behind initiation of this Seminar Series is to bring Graduate Students of the University and the Kingdom to a forum where they can present and discuss their research with each other.

The event it is inaugurated by H.E. the Rector.

The 6th Graduate Seminar Day has the following features:

- Presentations by graduate students of KFUPM as a preparation for the 3rd Saudi Student Conference to be held in April 2012. This is done in cooperation with the Deanship of Student Affairs.
- Presentations cover wide range of topics from Mathematics, Physics, Chemistry, Earth Sciences, Environmental Design, Computer Sciences and Engineering; Aerospace, Industrial, Civil, Chemical, Electrical, Mechanical and Petroleum Engineering; Management Information Systems and Accounting, Finance, Economics, and Architecture.

This year, the number of presentations is about three times compared with the 5th Graduate Seminar Day. Out of 238 submitted contributions, a total of 168 papers are selected for presentation. The overall acceptance ratio is 70%. The evaluation of the submitted papers was based on technical review by specialized faculty members. Every presentation will be evaluated by two faculty members. Students whose work is accepted shall receive the University incentive and their paper's abstract appears in the **6th** Graduate Seminar Book of Abstracts.

Your active participation encourages graduate students and help in promoting exchanging of research ideas and interdisciplinary research.

Thank you…

Dr. Salam A. Zummo
Dean of Graduate Studies

Summary of Contributions & Departments Coordinators

College	Session	Chair	Dept.	Department Coordinator	Contributions			
					Submitted	Accepted	% Acce	Total Acce
Science	1	Dr. Mohamed Abu-Sbeih	CHEM	Dr. Hasan Al-Muallem	16	12	75	22
			PHYS	Dr. Ali H. Al-Ramadhan	6	6	100	
			MATH	Dr. Mohammad Z. Abu-sbeih	4	4	100	
CCSE	2	Dr. Mahmoud Elish	ICS	Dr. Mahmoud Omar Elish	23	19	82	55
			SE	Dr. Mujahed Al-dhaifallah	19	13	68	
			COE	Dr. Tarek R. Sheltami	26	23	88	
CIM	3	Dr. Mourad Mansour	MBA	Dr. Mourad Mansour	2	1	50	1
CED	4	Dr. Mohammad Hassanain	ARE	Dr. Mohammad A. Hassanain Mr. Mohammad Babsail	14	7	50	10
			CRP	Dr. KhMd Nahiduzzaman	3	3	100	
College of Engineering Sciences and Applied Engineering	5	Dr. Basim Abussaud	CHE	Dr. Basim Ahmed Abussaud	4	4	100	80
			CE	Dr. Talat Bader	8	5	62	
			PETE	Dr. Enamul Hossain	32	12	37.5	
			AE	Dr. Farooq Saeed	3	3	100	
	6	Dr. Ali Muqaibel	EE	Dr. Ali Hussein Muqaibel	52	32	61.6	
	7	Dr. Abdel-Salam Eleiche	ME	Dr. Abdel-Salam M. Eleiche	26	24	92	
				TOTAL	**238**	**168**	**70**	**168**

Table of Content

Security In State Chart

Hamzah Luqman <hamza_loqman@yahoo.com>, Mohamed El-Attar
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Abstract

In contrast to use case model that we can represent the security requirements by using mis-use case and mal-activity, there is not any technique or method to model the security requirements in state chart during requirement engineering (RE). Due to the absences of any technique to model the security requirement during RE for state chart, the security requirements are left to be done by security experts and software developers. Since, the real time and embedded systems are best modeled by state charts; there is an urgent need to represent the behavior of the attackers and the system reaction against attacks. In this paper we will present new technique to represent or model the security requirements and issues in the state chart during the requirement engineering. This paper will propose new states notations to model all the behaviors of the system in the case of attacks, and the scenarios that should not happen.

Linux-based Mobile Operating Systems Native Code Malware: The Android Experience

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Abstract

Linux-based mobile operating systems are becoming a popular trend in the mobile market, hitting the pockets of smartphone users worldwide. Highly affected by the excellent Linux security reputation, users tend to feel more secure and may store sensitive unencrypted data on their hansets. In this work we present Android - the most popular Linux-based mobile operating system - and delve into its inner workings and security measures. Then we shed the light on the dark side of Android malware by studying the recent privilege escalation exploits and attempt to reverse engineer a dangerous malware called DroidDream. Moreover we feature an easy way to target current Android smartphones through USB."

ترجمة نشرات الادوية من الانجليزية الى العربية آليا

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Abstract

مولد نحوي للجمل العربية

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Abstract

ازدادت في الآونة الأخيرة أهمية وجود نظام لتوليد جمل عربية صحيحة نحوياً. وتكمن أهمية مثل هذا النظام في حاجة كثير من تطبيقات معالجة اللغة العربية – التي تتطلب تكوين جمل بشكل آلي – إليه كالترجمة الآلية، وإجابة الأسئلة باللغة الطبيعية، وغيرهما. ولكي يعمل نظام توليد الجمل العربية بشكل صحيح لابد من وجود قواعد تركيبية صحيحة للكلام العربي متوافقة مع الحاسب. يقدم هذا البحث دراسة لنظام توليد جمل عربية صحيحة نحوياً بغض النظر عن المفهوم والدلالة. وقد قمنا في هذا البحث بعمل دراسة لقواعد تركيبية مقترحة مسبقا للجمل العربية وعالجنا كثيرا من المشاكل الموجودة فيها مع إعادة صياغتها بطريقة متوافقة مع الحوسبة. وتعتمد هذه القواعد التركيبية على تقسيمات تتوائم مع احتياجات المعالجة الآلية باستخدام قواعد السياق الحر. ولتطبيق هذه القواعد استخدمنا برنامج لتوليد الجمل العربية وقاموس يحتوي على مجموعة من الكلمات العربية. وسنتناول في هذه الدراسة التصميم العام للمولد النحوي وعمله والمشاكل الموجودة في القواعد المستخدمة مع توضيح ما قمنا بمعالجته .

Framework for real time distributed educational systems

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Abstract

Real time education is an interesting aspect of distance education allowing different participants in this domain to communicate and collaborate with each other as seamlessly as traditional method. Many approaches have been proposed by different researchers to address this issue, but our approach which is based on DDS(Data Distribution Service) shows promising results. DDS provides a set of QoS that can be manipulated to target real time education domain and the result shows an interesting low latency transmission and high throughput of data transfer. A conceptual justification coupled with data analysis is provided to show the suitable of this solution to education systems. Our future work is on building an application using DDS for real time education systems.

Software Cloning: A quest for a solution.(AI Perspective)

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Abstarct

Cloning code is becoming an increasing activity done by several programmers especially when there is a tight schedule to finish their tasks. The difficulty of detecting clone code lies in the intentional modification of some segments of the code by the programmers which may result in difficult-to-track debugs and increasing cost of maintenance. There have been different approaches and techniques proposed in the literature to solve this issue. However, these approaches either target a specific aspect of the issue or biased to some criteria rather than others. A comparison study of these techniques –based on some criteria- is proposed by this paper favoring approaches borrowed from artificial intelligence discipline. A final analysis is provided to layout the foundation for a new proposed solution that outweighs previous approaches emphasizing the use of AI techniques.

Automatic Diacritics Restoration for Arabic Text

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Abstract

Diacritization in Arabic orthography is an essential disambiguation method for Arabic text. Arabic speakers, native or fluent, can easily infer the intended meaning of a text based on their expertise without the need for diacritization. As such, Modern Standard Arabic (MSA) text usually is not diacritized by its authors in contrast to Classical Arabic literature. The later has had much more emphasis on diacritization, most notably in sacred texts such as the Qur'an and the Hadith. This deficiency of diacritics can be troublesome for novice Arabic readers as they try to deduce the meaning of a sentence. Diacritization can also be extremely important for some of the computational Natural Language Processing (NLP) problems such as Text-To-Speech (TTS) and machine translation (MT). The purpose of this research work is to achieve the following two main objectives. First, we are creating an extensive diacritized corpus that is large enough for statistical training purposes and that also can serve as a standard benchmark for researchers in the field. Second, we are developing a hybrid algorithm that should achieve an acceptable level of accuracy in the diacritization of Arabic text with comparison to the latest available published results.

Investigating Saudi Arabian Students Perceptions of Learning Management Systems: A Case Study of the Blackboard WebCT System at KFUPM

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Abstract

Albeit the fact that there has been considerable research in the field of evaluating learning management systems, the ponderous question which leads researchers towards continuous work in this domain is the amenability of the multifarious issues within this domain. Given the various proposed frameworks and models for evaluating learning management systems, it is noteworthy to mention that only few of the studies aim at generalizing the evaluation methods to fit a wide variety of environments, i.e. to fit to different learning management systems in this context. This study proposes an abstract model (5-D model) to evaluate the students' perceptions of learning management systems. Five dimensions have been used in the study, namely; Students mindsets, Instructors involvement, Quality of System (QoS); Quality of course contents (QoC) and Quality of technical support (QoT). A survey questionnaire based on the aforementioned dimensions has been developed and applied to 328 undergraduate, graduate and postgraduate students who use the Blackboard WebCT system at the King Fahd University of Petroleum and Minerals, Saudi Arabia. The survey questionnaire has been checked for establishing the appropriateness of the proposed model in evaluating the students' perceptions of learning management systems using content validity, reliability and criterion based predictive validity. The idea behind using the stated validation methods is purely for comparative analysis with other studies, given the wide usage of the methods. The results are promising and conform to the claims of the study.

Agent-based Framework for Semantic Query-Manipulation and Personalized Retrieval of Health and Nutrition Information

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Abstract

Semantic manipulation of Website content is important in many domains, but it is critical in some domains such as health and nutrition. In such domains, users need to retrieve precise, trusted, and relevant health and food information. Even with a high quality semantic Web-based search engine, it is not enough for retrieving the right health and nutrition related information. That is because it might not fit to the user's specific needs as we have huge amount of information scattered in the Internet. Thus, personalization techniques will help and guide users in retrieving relative health and nutrition information consistent with their needs. The scope of this work is to investigate the current status of agent-based personalization techniques and to develop an ontology-based framework for semantically manipulating queries and retrieving personalized health and nutrition information. A detailed architecture of the framework has been developed to serve this purpose. Moreover, query templates were built to be used for semantically mapping the user's native queries into ontology-based queries enriching the user's queries based on the user's profile. In additions, user's profile attributes were studied to come up with a structure and an ontology of a user's profile needed for customizing the health and food information to the user's needs. The initial framework testing shows promising improvements in the relevancy of the retrieved results and of user's satisfaction.

A Network of Heterogeneous and Distributed Ontologies for Health and Nutrition Information System

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Abstract

Traditionally Web publishing is done independently by the content creators to publish Web pages and link them together. The current limitation of Web is that it is comprised of static links with no connection to any underlying domain knowledge. Semantic Web is the next generation Web that brings meanings to the information and attempts to break the syntactical representation of data so that it can be understood by the applications and machines, not just for the display purposes, but for annotation, integration, and reuse across applications. The semantic Web aims for the web resources which are machine-understandable and whose information can be accessed and correctly processed based on the ontologies, however these ontologies have been developed for different domains e.g., nutrition, healthcare, etc. independently. The landscape of ontology research is becoming more and more interested in the questions dealing with multiple heterogeneous ontologies. This paper describes the different approaches being used for ontologies integration and proposes an approach for integrating the ontologies for the health and nutrition related domains. The paper also discusses the previous researches related to multilingual support of ontologies and proposes two approaches to be used for culture specific knowledge extraction and reasoning. The initial framework testing shows promising improvements in the relevancy of the information retrieved.

Parking-Lot Monitoring System Based On Video Object Tracking Technique

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Abstract

Multilingual Framework for Ontology-Based Semantic Annotation of Health and Nutrition Websites

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Abstract

A large volume of web contents is available in unstructured and structured format. Creating metadata by annotating those existing web documents is one of the major techniques for putting machine understandable data on the Web. Though there exist many web annotating tools, none of them fully support the creation of semantically interlinked metadata of multilingual data sources that is necessary for a truly Semantic Web for specific domain. In this paper, we present a multilingual ontology-based annotation framework which offers comprehensive support for the creation of semantically interlinked metadata for structure and unstructured data sources related to health and nutrition domain. Moreover, investigation of the current status of semantic annotation research also carried out. A detailed architecture of the framework developed that cover both structured and unstructured web data sources. The framework consists of several integrated components including data acquisition, information extraction and knowledge base components. The initial testing of an implementation of the framework shows promising improvements on the amount and quality of data that can be captured.

Scalable Fast Parallel SVM on Cloud Clusters for Large Datasets Classification

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Abstract

A support vector machine (SVM) is supervised learning methods that analyze data and recognize patterns, used for classification and regression analysis. For testing and training of a multidimensional large datasets requires a lot of computing resources in terms of memory and computational power. We purposed a scalable and cost effective technique for running support vector machine in parallel on distributed cloud cluster nodes which reduced memory requirements and computational power. We divide the datasets in to 'n' equal parts and process each dataset part on distributed cluster. We combined produced support vectors of all the clusters nodes onto master node and again apply Support Vector Machine algorithm. We tested our solution on different datasets available online by using the local single node machine, HPC clusters and Amazon Cloud Clusters and done a comparison in term of efficiency and accuracy. We prove that our proposed solution is very efficient in terms of training time as compared to the existing techniques and it classifies the datasets correctly with minimal error rate.

A Comparison of Mamdani and Sugeno Adaptive Fuzzy Inference Systems for a Software Effort Prediction Model

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Abstract

With the recent trends in the field of Software Effort Prediction gravitating more towards the use of machine learning and evolutionary computation paradigms, predicting effort in software development environments using techniques such as Fuzzy Logic, Neural Networks, Genetic Algorithms or a combination of these has been positively acknowledged by the research community. This paper proposes to compare two widely used inference techniques related to adaptive fuzzy inference systems namely; Mamdani and Sugeno Systems. The Mamdani method uses pure fuzzy logic to train the Fuzzy Inference System where as the Sugeno method utilizes a neuro-fuzzy technique to train the Fuzzy Inference System. An Effort Prediction model based on Use-Cases is developed and training algorithms using both the methods are implemented. The simulation result demonstrates the differences between the two methods and highlights the benefit of using either one in accurately predicting effort.

Prioritization of Requirements Based on UCPD and Relations between Use Cases

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Abstract

A use case is a technique used in system analysis to define, illustrate, and organize system requirements. Using the use case will help to identify the scope and construct the sequence of the software. Prioritization the requirements based on the use case will be more useful for software project management and software quality improvement. There are several proposals to prioritize the software requirements depend on use cases. Most of these techniques prioritize the requirements according to the use cases scenarios, importance of use cases, and the inspection of use cases. This paper presents a novel approach of prioritizing use cases from the developer's perspective. This technique depends on use case precedence diagram (UCPD) and the dependencies between use cases.

The relationship between the UML design metrics and the external software Quality attributes: A systematic literature review

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Abstract

Context: UML has become the de facto for the design of software systems. A lot of work has been conducted to investigate the relationship between software quality attributes and UML design metrics. There has not been an attempt to summarize that work in a systematic manner. So we decided to perform a systematic literature review to investigate that relationship. Objective: We have two objectives of performing this systematic review. The first is to understand the relationship between the UML diagrams design metrics and the external quality attribute. The second is to identify the research gaps in this area.
Results: 14 primary studies are identified from among 355. Also 8 relationships were identified between the UML diagram metrics and the external quality attribute. Some of those relationship were positive some were negative and some show no significance.
Conclusion: We concluded that UML design metrics can act as a good indicator for external software quality attributes. Also we found only a few number of relationships have been investigated and more investigation is required to cover all the possible relationships.

Mining Frequent Structural Patterns from XML Datasets

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Abstract

Due its flexibility and capability for representing various kinds of data XML has become a de facto standard for data exchange over the net. Recently the use of XML has been increasing at tremendous pace. With the ever-increasing amount of data available in XML format the ability to mine valuable information from them has become increasingly important. However mining useful information from the XML is difficult due to its hierarchical tree structure. In this paper we are proposing a new and efficient algorithm for mining frequent structures from the XML documents. Unlike general trees XML trees have many repeated substructures. So the proposed algorithm exploits the presence of repeated substructures and does the following. First it clusters the input XML dataset by structure second it encodes the XML dataset objects in order to minimize storage space and to avoid string manipulation and third it applies Apriori algorithm on the clustered and encoded XML dataset to find the frequently repeated substructures. The experimental results show that the proposed algorithm significantly outperforms the standard Apriori based algorithm.

Extracting of Courtesy and Legal Amounts of Bank Checks

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Abstract

In this paper we analyze the bank check image. Image binarization and size normalization are applied as preprocessing steps. This is followed by the identification of the positions of the regions of interest in the bank check (viz. courtesy and legal amounts) and then extracting these regions. Check layout information is utilized in extracting these regions. Image dilation along with horizontal and vertical projections to extract courtesy amount region are used. To extract legal amount region, we utilized the information of the extracted courtesy amount region. Image registration and vertical projection are used to remove printed words from legal amount region. We carried out several experiments using real check images from the CENPARMI database. Extraction rate of courtesy amount fields is 100% while legal amount fields are extracted with an extraction rate of 84%.

Relationships between CK Metrics and External Software Quality Attributes: A Systematic Literature Review

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Abstract

The Chidamber and Kemerer (CK) metrics suite is the most widely accepted object-oriented design measure by researchers and software engineers. A great amount of empirical studies have been conducted to evaluate these metrics as indicators of external software quality attributes (ESQAs). However, there has been no attempt to systematically review and report this existing evidence. To identify the relation of CK metrics with ESQAs we have performed a systematic review of empirical evidence published in the literature that shows relation between CK metrics and ESQAs. Our search strategy identified 413 papers, out of which 32 papers were identified as reporting empirical evidence showing relation between CK metrics and ESQAs. Our results conclude that complexity, coupling and cohesion metrics are good indicators of ESQAs, and inheritance metrics are not useful indicators of ESQAs.

Department of System Engineering

Acoustic Mixture Classification using ICA and a Novel Coarse Grade AR Modeling

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Abstract

In passive acoustic surveillance systems it is necessary to separate and discriminate between the acoustic signals coming from different targets. These signals are first acquired as a mixture of various signals by an array of sensors (microphones), for further processing to detect and track them. In addition to mixing of the target signals, sometimes acquired data may be contaminated with other undesired signals generated by different noise sources such as biological noise due to birds and other living creatures. Furthermore there may be wind noise present at all times and moving platform noise if the system is mounted on it. In order to filter out the undesired signals, common techniques of fixed weight FIR/IIR band-pass filters cannot be applied due to the possibility of their power spectra being overlapped. At the same time, due to unavailability of the targets' reference locations, supervised adaptive filters cannot be employed for their detection. In this work we propose a combination of two techniques for the separation of the constituent acoustic signals from the acquired mixture and their classification into target and undesired signals. Signals are blindly separated using FastICA an Independent Component Analysis (ICA) algorithm. For classification we propose a new technique of Coarse Grade AR modeling of the acoustic signals. A self-organizing competitive Neural Network is used as a classifier. Whole scheme is tested on real world acoustic signals and an overall efficiency of 80% is obtained.

Water Desalination Using Solar Energy

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Abstract

Overlapping Decentralized sliding mode control design for H. B. Robinson Nuclear Power Plant

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Abstract

This paper discusses the overlapping decentralized sliding mode control (ODSMC) of H. B. Robinson Nuclear Power Plant (HBRNPP). This system is a large scale system with dynamic model of order 20. The system is decomposed into four overlapping subsystems and then controlled by a sliding mode controller. The control law is decentralized and thus it is capable to stabilize the system without the knowledge of interconnections associated with each subsystem. In addition to the system under consideration, simulations are also performed for a two-area power model for the sake of comparison of the results of the adopted technique (ODSMC) with the published LQR-based centralized and overlapping decentralized state feedback techniques. Simulations show that both systems are successfully stabilized with ODSMC approach.

Augmented Boiler –NOx model control using Model Predictive Technique

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Abstract

This paper addresses the problem of controlling a drum type boiler operation as well as its NOx emission level. For that purpose an augmented model integrating both boiler and NOx models has been developed. The system has multiple roots at the origin causing poor phase and gain stability margins. In addition, one of its inputs has been considered as an undesirable disturbance. Different control strategies have been studied and benchmarked. A two-stage Augmented Model Predictive control (MPC) controller with constraints demonstrated best performance. Computer simulations show the performance of such approach.

Multi-objective optimization models for process targeting under absence and presence of inspection error

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Abstract

The selection of the optimal process target is an important problem in production planning and quality control. Such process targeting problems are usually modeled in the literature using a single objectives optimization model. In this paper multi-objective optimization is introduced in the process targeting area. A multi-objective optimization model is developed for a process that produces a product with a quality characteristic y. The quality characteristic is normally distributed with unknown mean T and known variance σ2. The product has two specification limits one for a primary market and the other for a secondary market. If the item meets the first specification limit it is sold in a primary market and if it fails the primary market specification it is sold at a secondary market if it meets its specification. The item is scraped if it does not meet both markets specifications limits. The price at the primary market is higher than the secondary market. The objectives used in the model are to maximize profit, income and product uniformity using Taguchi quadratic function as a surrogate for product uniformity. 100% error-free inspection system is applied as the mean of the product control. After we studied the utility of this model, we studied the impact of the inspection error on the model. The presence of the inspection error affects both the producer in term of lost material, extra processing cost and warranty cost affects the end customers in term of paying more for poor quality. Hence, we formulated the model in the way to counter reduce the effect of inspection error in the outgoing quality. Algorithms are proposed to obtain and rank the set of Pareto optimal points for both models.

Determining Process Means and Optimal Rectifying Inspection Plans for Machines in Series

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Abstract

We consider a production system that consists of a set of machines in series. Production is in lots. Each lot is processed on each machine sequentially. After each machine, a sample of the lot is examined. If the number of defectives in the sample does not exceed a given threshold the lot is forwarded to the next machine. On the other hand if the number of defectives in the sample exceeds the threshold, the whole lot is examined, defective items are replaced with conforming ones and the lot is sold at a given price. The problem is to find the optimal mean of the quality characteristic at each machine that will minimize the total cost. This problem has been discussed in several papers. However, the current solution methods are very slow and do not guarantee that the optimal solution is obtained. We uncover a very intriguing special structure of the problem. This structure is efficiently used to design an extremely fast solution method to compute the mean at each machine. We further extend the problem by finding the optimal sampling plan i.e. find the optimal sample size and the optimal threshold each machine. This objective was never attempted before. Finally we prove that the objective function is not necessarily convex; hence an exhaustive search for the mean is necessary. We present an example with a large number of machines to illustrate the efficiency of the approach.

OKID-Based System Identification on Experimental Data of DC- Motor

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Abstract

Many identification methods of DC-motor have been developed for the open loop case. In this paper we proposed some of them for first and second order systems. In the beginning we collect DC-motor Input and Output Data using LabView and we applied many identification techniques the identification methods involved are: Recursive Least Squares Weighted Recursive Least Squares Instrumental Variable Least Squares Subspace Identification and observer Kalman identification (OKID). System formulation is established for second order systems. The controller design of this system is presented here by using linear quadratic Gaussian integral control.

ANFIS based-Kinematic Modeling of Mobile Parallel Robot

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Abstract

This paper considers a kinematic based ANFIS motion modeling and control of a mobile parallel robot (MPR), consist of a multi-degree of freedom (DOF) parallel manipulator and a mobile platform. First, kinematics modeling for the hybrid structure is derived. Then singularities of the MPR structure are identified. Taking the self motion into consideration due to the redundancy, the inverse kinematic is derived using hybrid neuro-fuzzy system called NeFIK. Simulation results show the effectiveness of the proposed approach.

Economic production lot size with two types of non-conforming items and shortages

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Abstract

Classical economic production quantity assumes that all items produced are perfect quality items, where this is not the real case behavior because the process may deteriorate or effected by environment or any other factors. The finite production rate model with two types of imperfect quality items produced is examined by this paper. Each produced lot contains portion of non-conforming items which contains two types. First type is a re-workable items which can be reworked after finishing of production time and become as good items. The portion of re-workable items considered being a random variable with known probability density function and re-workable cost, second type is a scrapped items which it has to be disposed with disposal cost and has known probability density function. Shortages backordered is allowed. In this paper we also investigate the case when we have unplanned shortages due to the portion of non-conforming items and the fact that rework rate is less than the demand rate. The effect of producing defective and re-workable items on optimal solution is studied while numerical example is provided for the developed model.

Production planning with re-workable and scrapped items

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Abstract

This paper considers the problem of satisfying constant and continuous demand through batch production at a finite rate. We assume that produced items may contain non-conforming ones that can be reworked and others that are scrapped. Costs are associated with these types of non-conforming items. The proportions of re-workable and scrapped items are random variables. In addition, we assume that shortages are permissible at some cost. This realistic scenario is modeled mathematically. We derive a closed form for the optimal batch size that result in minimizing the total cost of production, inventory and setup costs. It is shown that the global solution of the problem is obtained. An example is presented and sensitivity to changes in model parameters is studied.

Revisiting Non linear Control Design of a Ball on a Beam System: Sliding Mode Controller with an UKF Observer

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Abstract

The sliding mode control of the Ball on a Beam system is dealt with in this paper. Static and dynamic slidingmode controllers are designed using the complete model of the Ball on a Beam system. An observer is also designed using Unscented Kalman Filter. Simulation results show that the designed controller using Dynamic Sliding Mode Control (D-SMC) give less chattering with slightly slower response compared to Static Sliding Mode Control. The combination of UKF and D-SMC are capable to handle some degree of model mismatch and measurement loss in nonlinear model of Ball on Beam System."

Optimal Means for a Network of Continuous Processes

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Abstract

We discuss the problem of determining the means of a network of processes. Each process generates a random quality characteristic that in turn has lower and upper specification limits. Depending on the value of the quality characteristic, an item can be reworked, scrapped or forwarded to the next process. An item is reworked at the same stage. We first study systems comprised of networks of processes where items are processed in varying sets of processes. Next, we turn out attention to investigating clusters of processes of varying sequences, where products pass though multiple routes of processes. Selim and Al-Zu'bi (2011) provided a fast solution method for determining the optimum process means of product under the continuous production processes. Long term probabilities developed in Selim and Al-Zu'bi (2011) are used to construct the profit function for network production systems. Finally, we present a solution for operational decisions running production systems studied in the project. Keywords: Quality control; Process target levels.

In-pipe Leak Detection Based on Pressure Gradient

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Abstract

The unintentional release of fluid from pipelines is characterized as leak. Pipeline leaks may result for example from bad workmanship or from any destructive cause due to sudden changes of pressure corrosive action cracks defects in pipes or lack of maintenance. In most cases the deleterious effects associated with the occurrence of leaks may present serious problems. Therefore leaks must be quickly detected located and repaired. The problem of leak even becomes more serious when it is concerned with the vital supply of fresh water to a human society. In addition to health and environmental effects leakage of water can be very costly. It's estimated that Saudi Arabia where 90% of water needs is achieved by water desalination loses around 820 million USD per year mainly due to leaks.

The work objective is to design and construct a sensor that is able to detect leaks from the inside of the pipe. The sensor is designed to detect the pressure drop in the vicinity of the leak. Upon the detection of the leak the sensor can be used to generate an alarm which can be sent to the master alarm system for a pipe network. Moreover the system is tested in different operating conditions (detection effective zone sensor moving speed) to study the effect of those parameter and to find the optimal conditions at which the system can function effectively.

The Proposed idea takes advantage of the high pressure gradient in the vicinity of the leak to develop an in-pipe leak detection device. Studies showed that the large pressure drop inside the pipe due to leak is localized around the leak hole. This drop in pressure is limited to a small region close to the leak and can't be detected easily at the pipe centerline particularly for small leaks. Based on this fact one can place a sensor very close to the pipe wall to detect leaks based on the local pressure gradient. Figure (1) shows a typical study where the pressure distribution along the pipe centerline shows that it is difficult to detect the pressure drop at leak section. On the other hand the pressure distribution at a line 1mm from pipe wall shows a sudden drop in pressure at leak section; followed by a slight increase before it again matches that of the rest of the pipe. Results shown in Figure (1-b) inspired the idea to find ways of detecting the obvious jump in pressure distribution at leak location.

Resource Allocation in Multiuser OFDMA Using the Slope Method

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Abstract

This paper investigates the problem of sub-channel and power allocation in the downlink of multiuser orthogonal frequency division multiplexing (OFDM) systems. Most of the existing algorithms do not satisfy the fairness constraint and usually very complex which in turn increases the computational cost needed to perform them. In this paper a method for sub-channel and power allocation called the Slope Method is proposed. Unlike the other methods the slope method allocates sub-channels and power in a single step and not as two separate problems. The proposed method satisfies the fairness constraint (proportional rate constraint) while in the same time has the advantage of requiring simple mathematical computations. The simulation shows that the proposed method gives excellent results.

Enhanced Algorithm for Modular Division

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Abstract

A new algorithm to compute modular division is proposed for prime fields . The new algorithm is based on the Binary GCD and the Extended Euclidean algorithms. It combines the advantages of previously reported works of a constant iteration delay independent of the modulus size, and a simple control flow of high-speed. Constant time iterations are achieved through the use of carry-save representations, while the fast control flow is made possible by relying on simple shift operations for algorithm control. The algorithm has been modeled using VHDL and synthesized on XILINX FPGAs. Compared to previously reported works, our algorithm enjoys the smallest implementation area and a strong potential for a highly competitive speed

Indoor Navigation Algorithm for MAROFEX

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Abstract

Remotely Controlled Vehicle

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Abstract

Enhancing BLAST Runtime Using Diskless-Based High Performance Clusters

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Abstract

The Basic Local Alignment Search Tool (BLAST) is considered one of the most popular bioinformatics tool for finding similarities between a protein or DNA query and predefined sequences, using sequence alignment technique. For this reason, many researches were done to enable the BLAST algorithm to search gigantic genome databases on large parallel clusters. This paper explores our enhancement to the BLAST runtime by evaluating both the parallel BLAST algorithms onto a large diskless High Performance Cluster (HPC) that offers lower hardware cost and improved reliability, as opposed to conventional diskfull clusters. The paper also discusses the scalability of our implementation when running on the cluster. Our results show that BLAST performance is still comparable with the use of the diskless clusters, while enhancing the reliability of the BLAST environment.

Single Sign On (SSO) for Enterprise Search using Real Time Publish/Subscribe (RTPS) Middleware

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Abstract

With the recent trends in the domain of Enterprise Search Engine applications gaining importance across the world, more focus has been targeted at integrating access control properties such as Single-Sign-On with the search engine applications. With the use of Single-Sign-On (SSO) property, a user is able to log in one time at a single system in a group of multiple systems and use the same authentication to access all other systems. Considering the heterogeneous nature of Enterprise Search Engine applications, i.e. the presence of individual sub systems such as Intranet Web Pages, Document Management Systems, it is necessary that a user is required to follow the regular authentication-authorization routine to gain access to the internal systems. This paper aims at proposing an authentication-authorization model for SSO based Enterprise Search Engine Applications. The results highlight the positives of the model and aid in establishing the fact that the proposed model can be implemented in real time heterogeneous systems.

Efficient Variants of Square Contour Algorithm for Blind Equalization of QAM Signals

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Abstract

Adaptive equalizers remove signal distortion causing Inter-symbol Interference in bandlimited channels. The tap coefficients of these equalizers are time-varying and can be updated using several methods. When these do not include the transmission of a training sequence, it is referred to as blind equalization. Motivated by the radius-adjusted approach [13] which is a method to achieve blind equalizer tap adaptation based on the equalizer output distance for Quadrature Amplitude Modulated (QAM) signals, static square contours are defined around an estimated symbol in a QAM constellation, which create regions that correspond to fixed step sizes and weighting factors. As a result, the equalizer tap adjustment consists of a linearly weighted sum of adaptation criteria that is scaled by a variable step size. This approach is the basis of two new algorithms: the Variable step size Square Contour Algorithm (VSCA) and the Variable step size Square Contour Decision-Directed Algorithm (VSDA). The proposed schemes are compared with existing blind equalization algorithms in the SCA family in terms of convergence speed, constellation eye opening and residual ISI suppression. Simulation results for 64-QAM signaling over empirically derived microwave radio channels confirm the efficacy of the proposed algorithms.

Verilog Implementation of a Blind Channel Equalizer

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Abstract

Adaptive equalizers remove signal distortion causing Inter-symbol Interference in bandlimited channels. The tap coefficients of these equalizers are time-varying and can be updated using several methods. When these do not include the transmission of a training sequence, it is referred to as blind equalization. Motivated by the radius-adjusted approach [13] which is a method to achieve blind equalizer tap adaptation based on the equalizer output distance for Quadrature Amplitude Modulated (QAM) signals, static square contours are defined around an estimated symbol in a QAM constellation, which create regions that correspond to fixed step sizes and weighting factors. As a result, the equalizer tap adjustment consists of a linearly weighted sum of adaptation criteria that is scaled by a variable step size. This approach is the basis of two new algorithms: the Variable step size Square Contour Algorithm (VSCA) and the Variable step size Square Contour Decision-Directed Algorithm (VSDA). The proposed schemes are compared with existing blind equalization algorithms in the SCA family in terms of convergence speed, constellation eye opening and residual ISI suppression. Simulation results for 64-QAM signaling over empirically derived microwave radio channels confirm the efficacy of the proposed algorithms. A custom implementation of a blind adaptive equalizer based on the proposed schemes is presented. The system can be configured to operate in one error signal mode, VSCA, for square QAM signals up to 64-QAM. The simulations were carried out using the ModelSim 6.1f.

TCP Congestion Control Using H ∞ Methods

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Abstract

H-∞ TCP controller for end-to-end TCP congestion control will be designed in this term project. The proposed controller which is based on the algorithm of TCP is aimed to minimize error term in TCP and achieve one step optimal solution for TCP congestion control. The simulation results indicate that □∞ controller improves TCP congestion performance in terms of higher link utilization less time delay and better fairness for a heavily congested network.

Finally a dynamic threshold setting scheme is developed to improve H∞ controller for both less congested network and heavily congested network. The significance of the research is that a better TCP congestion controller with higher total throughput less time delay and more stable congestion window size is achieved

Geo-Cipher: Design, Implementation and Analysis of a Map-Based Graphical Password System

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Abstract

A Multi-Click, Multi-Cursor Graphical Password Scheme (MC)2 for Effective User Authentication

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Abstract

Rank Based Sleep Scheduling (RBSS) Protocol for WSNs in a Fixed Grid Topology

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Abstract

A low-cost Test and Characterization Processor for at-speed Testing of ASICs

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Abstract

OPC-Enabled Distributed Control Systems over Data Distribution Service (DDS)

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Abstract

Identifying the Direction of a Phenomenon in Wireless Sensor Networks

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Abstract

This paper describes a novel method for determining the direction of a phenomenon in wireless sensor networks (WSNs). The method is based on a structured grid topology and mainly depends on analyzing the timestamp of each node in the grid at the base station. The topology and the routing protocol are conducted by simulation using OmNet++ and MiXiM 2.1 framework. Throughput, latency and average power consumption are measured and compared in order to investigate the efficiency of our method.

Security Implication of Cloud Computing : A Survey

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Abstract

Cloud computing is among the major trends in IT industry which enables individuals and enterprises to expand their business without caring for additional resource costs. It enables to lease service from the cloud service provider. Cloud computing brings huge benefits to the user but along with these benefit security holes have been found. Software As A Service, Platform As A Service and Infrastructure As A Service are the major services provided by cloud computing. This survey provides a brief introduction to what cloud computing is and the associated security implications. The survey also outlines some proposed solutions in the literature.

Hardware Implimentation of Collection Tree Protocol

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Abstract

Rapid advances in networking and integration have allowed small, flexible, low-cost nodes to interact with their environment and with each other through sensors, actuators and communication. Sensor networks potentially employ thousands of these nodes, each of which executes concurrent, sensitive programs that must operate with severe memory and power limitations. This paper describes the experiments that were carried out to successfully implement CTP on MICAz motes and observe it for different scenarios. We describe our experiences, the problems encountered and achievements.

Real – Time Publish/Subscribe Middlewares for Mobile Computing

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Abstract

Sharing data among mobile devices has become a common practice among the users. Developing applications for sharing data among heterogeneous mobile devices is very difficult. The OMG (Object Management Group) DDS (Data Distribution Service) specification provides a standard for a range of real-time mobile systems and embedded computing environments, from small networked embedded systems up to large – scale information backbones. The DDS has naturally distinguishing features such as asynchronous interaction, Quality of Service (QoS) support, and a dynamic discovery to support the mobile computing. In this paper, we have proposed a service architecture model for Mobility-Aware Data Transfer Service (MADTS) based on DDS to hide disconnections during the data communication among the two mobile nodes due to the movement of one or both nodes. We have introduced the DDS QoS that are applicable to mobile computing and also identified the values that are required in our model. We have done various experiments to identify the capabilities of RTI-DDS in a heterogeneous environment, in terms of hardware and operating system, to test the performance of RTI-DDS, in terms of latency and throughput.

LP FORMULATION FOR THERMAL MANAGEMENT OF A BIOSENSOR NETWORK

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Abstract

This paper discusses the implementation of Markov decision processes using the linear programming approach. In this realm the IBM CPLEX linear programming solver is becoming a de-facto standard. The motivation for this paper comes from the area of Biosensor networks in which the objective is to find an optimal policy that maximizes the life of a biosensor implanted in the human body and keeps the temperature of biosensor with in operable and safety zone. There is plethora of techniques to solve this problem, to name a few, Markov decision processes (MDPs), relative value iteration (RVI), policy iteration (PI). We apply the discounted cost linear programming model and compare the results of Cplex optimizer with policy simulations. We then do some policy characterization based on visualizing the policy outcomes.

Design Issues in Industrial Wireless Sensor Networks (IWSNs) and Proposed Solutions: A Survey

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Abstract

Wireless Sensor Networks have attracted a lot of attention by the industry due to their ability to provide a low cost solution to improving process efficiencies and productivity of industrial systems. The industrial wireless sensor networks (IWSNs) also provide several advantages over the traditional wired infrastructure such as self-organization, rapid deployment, flexibility, and inherent intelligent-processing capability. However, many factors such as reliability, latency, security and scalability have prevented their widespread deployment. This paper presents a survey of some of these factors and the solutions proposed in literature to overcome these drawbacks.

Real Time System for Health Monitoring of Civilians Transportation Drivers

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Abstract

Due to the extensive pressure that face civilian's transportation drivers during their jobs and the existence of some old drivers that are still working, there is a risk of health problems during daily work hours , even if they were forced to do periodic medical check. The results of a heart attack for example may be catastrophic and harmful for civilians; all passengers may be died because of this sudden event for the driver. In this situation it would be helpful if we design a real time system that will predict the sudden heart attack before it happened based on the biological indicators of the driver and pass them to Artificial Neural Network (ANN) that will give a prediction for the drivers situation. The middleware will receive the decision made by ANN and take care of current situation. The system must take care of both the vehicle and the driver. The driver must be alerted and in case of driver failure to response, it should take over the control on the vehicle to prevent disaster. In this paper a system prototype is built in an attempt to build a solution for this problem based on RTI, ANN and DDS Standards. Using C# language in conjunction with RTI code generation of publishers and subscribers. The model was tested against latency and late data and against successful prediction rate. Two prototypes were suggested and tested. The results show that the prototype based on DDS cloud is much more effective in performance. Results also show that late data and missed values negatively affects successful prediction rate. A set of quality of services (QoS's) in DDS standard are applied in this model.

Security Improvement of PVD Steganographic Method Against Histogram Attack

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Abstract

The pixel-value differencing (PVD) method is one of the steganographic methods that provide higher embedding capacity without very noticeable artifacts in the cover image to human eyes. However, stego-images generated by PVD can be detected using histogram analysis of the pixel pair differences. Also once the image is known to have embedded data, the extraction algorithm of PVD can be applied to retrieve the embedded message. In this paper, we propose a new modification to the original PVD based on logistic chaotic maps. The aim is not only to increase its security against the histogram analysis, but also to add another level of challenge for extracting the secret message by the steganalyzer. The proposed method is empirically evaluated and compared with the original PVD on several images.

High-Capacity Steganographic Method Based on Overlapped PVD

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Abstract

Several methods have been proposed based on pixel value differencing (PVD) with an attempt to increase the embedding capacity of secret data into digital images without great loss in the image quality. Among of these methods is the overlapping pixel-value differencing (OPVD). Although this approach can hide more data than the original PVD, it skips huge number of pixels in the embedding process because of the out range problem. In addition, it has some security limitations. In this paper, a high capacity steganographic method is proposed based on the overlapping concept. Our method successfully overcomes the weakness of overlapping pixel-value differencing approach while maintaining the image quality.

Symmetry Analysis and Exact Invariant Solutions of Linear Klein Gordon Equation on a Sphere

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Abstract

Klein Gordon equations in curved spaces play a significant role in study of the relativistic equations of motion in curved spaces. In this paper, an investigation of linear Klein Gordon equation on a sphere is carried out. Lie group analysis is employed to find the symmetry algebra and derive some exact invariant solutions of linear Klein Gordon equation on a sphere.

Symmetries and Exact Solutions of the Wave Equation on Torus

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Abstract

In this paper, the wave equation on torus is considered. We explicitly discuss the Lie symmetry algebra of the wave equation on torus based on the classical Lie theory. Symmetry reductions are obtained using similarity variables which are further analyzed to obtain new exact solutions of wave equation on torus.

Symmetry Analysis of the Wave Equation on Schwarzschild Spacetime

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Abstract

Schwarzschild spacetime is a physically significant and best understood model that provides solution to Einstein's field equations. It describes the gravitational field outside a spherical, uncharged, non-rotating mass such as a (non-rotating) star, planet or black hole. This work is focused towards carrying out a symmetry analysis of the wave equation on Schwarzschild spacetime. Lie symmetries of the wave equation are found. The wave equation is reduced to a PDE in two variables using a combination of symmetries. Finally some exact solutions are obtained by further analyzing the reduced PDE.

Existence of Solutions for Nonlinear Parabolic Equations with Integral Initial Conditions

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Abstract

We prove the existence of the strong solution for a nonlinear parabolic equation with integral initial condition. Our technique is based on the Green's function, integral representation of solutions and fixed point theorems.

Department of Physics

Simulation of a Photon Beam Linear Accelerator and Dose Calculation in a Patient Using Monte Carlo Technique

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Abstract

We have simulated a 6MV linear accelerator (CLINAC 2300C/D) using the EGSnrc/BEAMnrc Monte Carlo source code for a 10×10 cm field size. To validate the simulation we calculated the percent depth dose and dose profiles and compared the results with experimental data from King Fahd Specialist Hospital, Dammam. Using the simulated beam, we calculated the dose distribution inside a phantom and compared the results with the Eclipse treatment planning system (TPS). Result showed a good agreement between the measured percent depth dose data from the LINAC output data and that obtained from simulation to within 5% for depths greater that the depth of maximum dose. The beam profiles also compared well with the experimental data in the flat region of the beam but not in the penumbra region. The dose distribution in the patient from the TPS also showed a good agreement to within 5% of the Monte Carlo simulation data. However, the exit dose from the TPS showed an underestimated dose when compared to the Monte Carlo results. The Monte Carlo simulation entrance skin dose was lower that the TPS value. With these results, we can conclude that the EGSnrc Monte Carlo code with its components can be a useful tool for validating the dose distribution from TPS and gives more accurate results at interfaces between different tissues and air.

Determination of Mercury Concentration in Water Samples using PGNAA Technique by Analyzing the Response of $LaBr_3$:Ce Detector

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Abstract :

In this study ,the response of a $LaBr_3$:Ce detector was tested for the detection of Low Energy Prompt Gamma-Rays from mercury contaminated water samples of different concentrations using a portable neutron generator spectrum. In spite of the activation during sample irradiation ,the detector has excellent energy resolution to resolve mercury prompt gamma-rays from background prompt gamma-rays. The excellent agreement between the experimental yield of prompt gamma-rays with the calculated yield of prompt gamma -rays for the given concentration ,shows the $LaBr_3$:Ce detector excellent performance in detecting the low energy prompt gamma- rays

Synthesis and Characterization of Zinc Oxide (ZnO) Nanopowders Doped with Copper by Microwave Assisted Polyol Method

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Abstract

In this work, pure and Cu doped ZnO samples ($Zn_{1-x}Cu_xO$, x=0, 0.02, 0.04, 0.06, 0.08, 0.10, 0.12, 0.14) have been prepared using microwave assisted polyol method from zinc and copper acetates dissolved into diethylene glycol (DEG) at 180 and 200°C.
Effects of doping on the structure, morphology and optical properties of synthesized samples have been characterized by X-Ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM) and UV-visible light spectroscopy (UV-vis).
XRD results demonstrated that pure and doped ZnO have a hexagonal structure. The mean grain sizes of samples synthesized at 180 °C varied from 5.8 to 10.13 nm, while those synthesized at 200°C are varied from 11.14 to 19.5 nm.
FESEM investigation revealed that the shape of primary nanoparticles is spherical and it is strongly agglomerated to large spherical particles.
Optical absorption measurements showed that the absorption edge shifts gradually to the longer wavelengths (red shift region) as Cu doping concentration increases and the energy band gap values of synthesized pure and doped ZnO samples decreased from 3.238 to 3.108 eV.

Investigation of Beam Set up For Total Skin Electron Therapy (TSET) Technique

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Abstract:

Total skin electron therapy (TSET) is a special radiotherapeutic technique used to treat a variety of cutaneous malignancies where most or all of the skin is involved. The aim of the treatment is to irradiate the whole skin to a uniform dose profile within ±10%, both circumferentially around the patient as well as along the patient's length, while sparing the underlying organs. At King Fahd Specialist Hospital - Dammam, two irradiation techniques using a 6 MeV high dose rate (888 MU/min) electron beam from a Clinac 2300CD (Varian Medical Systems. Inc., Palo Alto, Ca, USA) are being investigated. For both techniques, the patient stands on a stationary platform 30 cm above the ground at a Source-to-Skin distance of 400 cm and is irradiated in six different positions to cover all parts of the body. Production of a flat beam profile in the first technique is based on a dual field irradiation with fields aiming above and below the mid-horizontal level. In the second technique, a flat beam is obtained using a custom made flattening filter with a single large field. We are in the process of designing and testing a filter for the production of flat beam profile. Percentage depth dose curves at 100 cm and at 400 cm were measured using a Markus parallel plate ionization chamber and beam profiles were measured using 20 MOSFET dosimeters. We have measured the beam output for the single stationary dual beams and the unfiltered single field beam. We have also measured an "effective" output correction factor that relates the output at a point from all 6 irradiation positions to that from a single irradiation position.

Thermal oxidation of electron-beam evaporated iron thin films

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Abstract

This work is concerned about the growth and characterization of iron oxide thin films. The films were grown by electron beam evaporation technique from pure (99.99%) metallic iron as a target material on fused silica substrates in vacuum~10^{-4} Pa. After deposition, the films were annealed in air at different temperatures ranging from 200 ^{o}C to 500 ^{o}C in order to study the effect of post annealing. α-Fe_2O_3 phase was obtained at annealing temperatures 400 ^{o}C and above. The structural properties were investigated by using X-ray diffraction (XRD) which showed the polycrystalline structure with nano-crystallite size. The crystallinity of the films was improved with increasing annealing temperature. Morphological analyses were done by atomic force microscopy (AFM) which indicated a considerable increase in roughness and grain size with annealing temperature.

Optical properties of iron oxide thin films

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Abstract:

Iron thin films were deposited in vacuum on fused silica substrates from a pure (99.99%) iron target using electron beam evaporation technique. The films were transformed into Hematite (α-Fe_2O_3) phase upon post annealing at 400^{o}C and 500^{o}C. X-ray diffraction (XRD) and atomic force microscopy (AFM) results showed that the films were exhibiting polycrystalline structure and possessed rough surfaces with increasing the annealing temperature. The optical properties of the films, including the refractive index n, extinction coefficient k, absorption coefficient α, and band gap E_g were determined from spectrophotometric measurements. Transmittance and reflectance of the films were also measured. The films had high refractive indices and possessed direct band gap around 2.42 eV to 2.67 eV.

Department of Chemistry

Microtitration by Differential electrolytic potentiometry using bare and Carbon nanotubes modified Silver electrodes

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Abstract

Titration is a common technique which is normally practiced in various laboratories. The classical methods of titration require large volumes of chemicals. Microtitrimery, which requires very small volumes of chemicals will help in saving large volumes of reagents, eventually will make lot of savings and protect the environment from large quantities of wastes. In this paper, microtitrimetry is performed by employing the technique of differential electrolytic potentiometry for the location of the end point. Precipitation titrations using silver electrodes are described. For the first time the endpoint for a sample of 1.0 µL of 0.05 M NaCl has been located by titrating it with AgNO3. The optimum conditions such as the current applied to polarize the electrodes in case of dc DEP are described. The effect of changing the percentage bias of the square wave used to polarize the electrodes on the differential peak in case of ac DEP has been investigated. The precision and the dynamic range of this microtitrimetric method are reported.

Microtitremetric Assay of Ascorbic Acid by Differential Electrolytic Potentiometry

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Abstract

Titration is a common technique which is normally practiced in various laboratories. The classical methods of titration require large volumes of chemicals. Microtitrimery, which requires very small volumes of chemicals will help in saving large volumes of reagents, eventually will make lot of savings and protect the environment from large quantities of wastes.
In this paper, microtitrimetry is performed by employing the technique of differential electrolytic potentiometry for the location of the end point.
Oxidation reduction titrations using platinum electrodes are described. For the first time the endpoint for a sample of 2.0μL of 0.10 M ascorbic acid has been located by titrating it with Ce (IV).
The optimum conditions such as the volume of cerium ammonium sulphate added, the current applied to polarize the electrodes in case of dc DEP are described.
The effect of changing the percentage bias of the square wave used to polarize the electrodes on the differential peak in case of ac DEP has investigated. The precision of this Microtitremetric method has been reported.

Synthesis and solution properties of a novel electrolyte-zwitterionic/sulfur dioxide copolymer

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Abstract

The zwitterionic monomer, *N*-carboethoxymethyl-3-(*N*,*N*-diallylamino)propanesulfonate was copolymerized with sulfur dioxide in dimethyl sulfoxide using azo-bis-isobutyronitrile (AIBN) to afford the polyzwitterions (PZ) copolymer in excellent yields. The PZ was converted into the corresponding acid (PZA) by acid mediated hydrolysis. Treatment of PZA with NaOH generated the corresponding anionic polyelectrolyte-zwitterion (PEZ). NMR and IR spectroscopic techniques were used in the physical characterization of the polymers. The solubility, viscosity behaviors and solution properties in the presence and absence of added salt (e.g. NaCl) were studied in details. The PEZ posses and extraordinarily high viscosity in salt free water.

SYNTHESIS OF POLYSULFONATES USING CYCLOPOLYMERIZATION OF SPECIALTY DIALLYLAMMONIUM SALTS

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Abstract

The synthesis of a novel polyelectrolyte-zwitterion (PEZ) has been achieved. The zwitterionic monomer, *N*-carboethoxymethyl-3-(*N*,*N*-diallylamino)propanesulfonate was synthesized and cyclopolymerized using tertiary butylhydroperoxide (TBHP) as the initiator to furnish the polyzwitterions (PZ) whereby acid hydrolysis of the pendant ester yielded the corresponding polyzwitterionic acid (PZA). Treatment of PZA with NaOH generated the corresponding anionic polyelectrolyte-zwitterion (PEZ). The PEZ possess structural features that are identical to both conventional anionic polyelectrolytes and polyzwitterions.

NMR and IR spectroscopic techniques were used in the physical characterization of the polymers. Solution properties of the polymers were studied in detail that included: (a) solubility behaviors; (b) viscosity behaviors and solution properties in the presence and absence of added salt (e.g. NaCl). The PZ displays unusual solubility properties while its viscosity behavior is typical of common PZs. The electrolytic part of the PEZ is seemed to control viscosity behavior of the PEZ.

Efficiency Optimization in a Distillation Unit exhibiting Excessive Scale Formation

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Abstract

Over a period of 2 years in service, a heavy scale build-up was observed at the outer surfaces of heating tube bundles that make up the evaporator shell of a multi-effects distillation (MED) unit employed in an onshore oil producing facility. The unit production rate was dropped by 30% below design capacity due to scale formation. A series of acid cleaning procedures, including: 17 batches of 10% sulfamic acid and 12 batches of ethylenediaminetetraacetic acid (EDTA), were used to clean the scale deposit at 68^{o}C, with limited success. Progressive scale build-up at the outer surfaces of heating tubes of an evaporator is an inevitable process. Even with stringent control of feedwater and condensate chemistry, scale formation and deposition will occur. The main problems caused by scales include an increase in tube wall temperature, which can lead to a decrease in overall efficiency, and tube ruptures. The increase in tube wall temperature is due to low thermal conductivity of scales as compared to metal. The reduction in heat-transfer can lead to the design temperature of the tube wall being exceeded, which in turn may lead to failure of the tube by creep rupture. Since scaling impedes heat transfer, more fuel is required to produce a given amount of steam, thus reducing overall efficiency. This results in an increase in energy cost and a loss of process reliability. Minimizing the scale build-up of scale becomes essential to optimize the MED unit efficiency that will lead to use less fuel. The paper discusses the main root causes of the scale build-up and addresses recommendations to prevent such occurrences in the future. Also, this paper considers the economic benefit from the perspective of process cost.

Investigation of acid-base character of gold nanoparticles supported on alumina and magnesia-alumina supports: Use of 2-propanol decomposition as test reaction

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Abstract

γ-Al2O3,4%MgO-Al2O3,8%MgO-Al2O3 and 1%Au supported on all of these catalysts were prepared by modified Sol-Gel method. The catalysts were chracterised by XRD, BET, TPD, TEM, ICP and DRIFTS. TEM and XRD Pattern showed that Au was highly dispersed over these catalysts. The selectivity and catalytic activity of the catalysts in the 2-propanol dehydrogenation/dehydration reactions was investigated. The obtained results showed that the addition of magnesia to alumina to form a MgO-γ-Al_2O_3 mixture had a pronounced effect on the catalytic properties of the resulting MgO-Al_2O_3 support and its 1% gold supported equivalent.

Synthesis, characterization and anti-proliferative effect of [Au(diamine)Cl_2]Cl complexes on human cancer cell lines

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Abstract

A series of gold(III) complexes of five, six and seven membered ring was prepared by reacting Auric acid ($HAuCl_4 \cdot 3H_2O$) with one equivalent ethylenediamine (en), propylene diamine (pn) and butylenediamine (bn) as ligands. These complexes were characterized by some analytical and spectroscopic techniques. The solid state ^{15}N NMR shows that the chemical shift difference between free and bound ligand decreases as bn > pn > en, indicating stronger Au-N bond for bn complex compared to pn and en. UV-Vis shows relative stability of the Au(III) complexes of en. Far-IR data reflect [Au(pn)Cl_2]Cl to be more stable. Potential of [Au(en)Cl_2]Cl, [Au(pn)Cl_2]Cl, and [Au(bn)Cl_2]Cl complexes as anti cancer agents was investigated. All gold (III) complexes showed concentration dependent cytotoxic effect on cancerous cells PC-3 and SGC-7901. It is also observed that cell proliferation of [Au(pn)Cl_2]Cl on PC-3 cells is bit higher than that of [Au(en)Cl_2]Cl .

Anti-cancer activity of new gold(III) complexes of $[Au(en)_2]Cl_3$ and its derivatives against human prostate and gastric cancer cell lines

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Abstract

A series of Au(III) complexes of the type $[Au(L)_2]Cl_3$ (where L = *en*,..... and *N* substituted *en*) were synthesized by reacting Auric acid ($HAuCl_4 \cdot 3H_2O$) with 2 equivalent of corresponding alkyldiamines or N-alkyl substituted ethylenediamine ligands. These complexes were characterized by various analytical and spectroscopic techniques such as Elemental Analysis, UV-Vis, Far-IR, ^{1}H NMR and solution ^{13}C as well as solid ^{13}C and ^{15}N NMR. The potential of these complexes as anti-cancer agents was investigated by measuring some relevant physicochemical and biochemical properties. The stability of Au-N bonds was established by Far IR vibrational stretching as well as cytotoxicity. The solid-state ^{15}N NMR chemical shift shows that the ligand is strongly bound to gold(III) via N atoms comparing the chemical shift of the free ligand. Such gold (III) complexes shows stability under physiological condition and presents promising cytotoxic effect against selected human cancer cell lines, making them good candidates as anti-cancer agents.

Electrochemical Investigation and Analytical Determination of Ciprofloxacin in Pure and Drug Formulation Forms

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Abstract

A simple, rapid and sensitive electrochemical method was developed for the investigation and analytical determination of ciprofloxacin (CPF) antibiotic at a new composite material, glassy carbon paste electrode surface. The electroanalytical technique adopted to assess the factors influencing the trace measurement of CPF was square wave stripping voltammetry. This method depends on voltammetry activity of CPF in 0.1 M phosphate buffer solutions with the best anodic peak obtainable at pH 5. Under optimized conditions in the voltammetry method, a dynamic calibration curve was obtained in the concentration range of 50 ppb to 800 ppb (1.50×10^{-7} to 2.08×10^{-6} M) at a 1.0 mm diameter electrode surface with a detection limit of 10 ppb (2.50×10^{-8} M). The new composite electrode is highly reproducible with relative standard deviation (RSD) of 5.14% for a series of seven repeated measurements at different renewable surfaces of the glassy carbon paste at the same concentration level. The developed method was used to determine the concentration of ciprofloxacin (active ingredient) in Floxacin and Ciproxen commercial drugs by standard addition method.

Removal of heavy metal ions using a novel cross-linked polyphosphonate

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Abstract

A novel cross-linked polyzwitterionic acid (CPZA) was synthesized via cyclocopolymerization of diallylaminomethylphosphonic acid and 1,1,4,4-tetraallylpiperazinium dichloride (10 mol%), a cross-linker, in the presence of tert-butylhydroperoxide in aqueous solution at 85 ^{o}C. CPZA, upon treatment with NaOH, was converted into a cross-linked anionic polyelectrolyte (CAPE). The experimental data for the adsorption of Pb^{2+} and Cu^{2+} on CAPE fitted Lagergren second-order kinetic model and Langmuir as well as Freundlich isotherm models. The adsorption capacity of Pb^{2+} was higher than that of Cu^{2+}, while the rate of adsorption was found to be higher for Cu^{2+}. The adsorption process was spontaneous and endothermic in nature with negative and positive values for ΔG and ΔH, respectively. The low activation energies of 12.8 and 17.9 kJ/mol for Cu^{2+} and Pb^{2+}, respectively, indicated the adsorption as a favorable process. The excellent adsorption and desorption efficiencies implied the efficacy of the resin in removing as well as recovering the metal ions from aqueous solution. An efficient synthetic access to the resin would enable its use in the treatment of contaminated waste water.

pH-Responsive Polyphosphonates Using Butler's Cyclopolymerization

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Abstract

The cationic monomer, *N*,*N*-diallyl-(diethylphosphonato)methylammonium chloride, and zwitterionic monomer, Ethyl 3-(*N*,*N*-diallylammonio)methanephosphonate, were cyclopolymerized in aqueous solutions using ammonium persulfate or t-butylhydroperoxide as initiators to afford a cationic polyelectrolyte (CPE) and a polyzwitterion ester (PZE), respectively. The CPE and PZE on acidic hydrolysis of the ester functionalities afforded the same polyzwitterionic acid (PZA): poly[3-(*N*,*N*-diallylammonio)methanephosphonic acid]. The solution properties of the CPE, pH-responsive PZE and PZA were studied in detail by potentiometric and viscometric techniques. Basicity constants of the amine and phosphonate ($P=O(OEt)O^-$) groups in the conjugate base of the PZE were found to be "apparent" and as such follow the modified Henderson-Hasselbalch equation. In contrast to many polycarbo- and –sulfobetaines, PZE was found to be soluble in salt-free water as well as salt (including Ca^{2+}, Li^+)-added solutions, and demonstrated 'antipolyelectrolyte'solution behaviour. The PZA, on the other hand, was found to be insoluble in salt-free water, and on treatment with NaOH gave dianionic polyelectrolyte (DAPE) containing trivalent nitrogen and [$P=O(O)^{2-}$] groups. For the first time, several new phase diagrams of poly ethyleneglycol (PEG)-DAPE aqueous to-phase systems (ATPSs) have been constructed in the presence of varying proportions of HCl. The ATPSs may find application in affinity partitioning of metal ions since DAPE is expected to be an effective chelator.

Synthesis, characterization and hydrodesulfurization (HDS) of Mo-SBA-15 catalyst with increased and well dispersed MoO_3 particles

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Abstract

Mesoporous silica, SBA-15 containing up to about 14% weight of molybdenum active phase have been synthesized by co-condensation from acqueous solution of their precursors. The bulk metal contents of the synthesized materials were determined by ICP-AES. Other characterizations were done by nitrogen physiosorption, DR UV-vis., Raman and XRD. Results of our characterization show somewhat good dispersion of MoO_3active phase on the SBA-15 support. The performance of the catalyst was evaluated in the Hydrodesulfurization (HDS) of dibenzothiophene (DBT).

Civil Engineering Department

Numerical Simulation of Slump Flow and L-box Tests for Self-Compacting Concrete (SCC)

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Abstract

Flowability, passing ability and stability are important properties to be considered while designing a robust self-compacting concrete (SCC). Numerical simulation of SCC is a valuable tool, which can be used as a means to model and predict concrete workability and to tailor its rheological properties. The simulation of SCC flow could be used for obtaining optimum rheology of the mix to ensure its mobility and segregation resistance during placement. This paper presents the results of numerical simulation of SCC flow using a 2-D computational fluid dynamics (CFD) framework. The Bingham behavior was modeled by means of a Herschel-Bulkley viscosity model in the software ANSYS/FLUENT for the Slump flow and L-box tests. SCC mixes with limestone powder (LSP) were simulated. The numerical simulation show excellent agreement with the experimental results against which the model's validation was carried out.

Simulation of the Effect of Damage on Chloride Diffusion into Stressed Reinforced Concrete

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Abstract

This paper studies the effect of damage imparted by the service loading on chloride diffusion in concrete. The effect of the damage was evaluated using a simplified damage model which maps the stress distribution in the beam's cross-section to a dimensionless damage parameter. Due to the low concrete tensile strength as compared to its compressive strength, only the tensile stress distribution within the tensile zone was considered for the damage prediction. Also, due to the non-homogeneous nature of reinforced concrete section the transformed moment of inertia of the designed concrete section was used to arrive at the stress distribution.

Finite Element Modeling of Composite Plate Girder

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Abstract

Steel–concrete composite girders have been extensively used in building and bridge construction. Composite action can be achieved by means of mechanical shear connectors, header stud shear connectors are usually welded to the top flange of a steel beam to resist longitudinal slip or vertical separation between the concrete and steel beam.

The composite action of the composite plate girders increases the shear and bending capacity. Many factors affecting the composite action of the full composite plate girder such as slab thickness, web slenderness ratio, and shear connectors, also the type of loading on the section, web aspect ratio, span length, and sizes of stiffeners. It is observed that the composite action is more effective for girders with slender webs.The percentage increase of ultimate load is more significant to girders with slender webs than those of thicker webs.

The Modeling Impact of Dewatering on Soil Structure Interaction Using SAP

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Abstract

In the eastern province of Saudi Arabia, the level of water table is high which reduced the soil capacity. Therefore, dewatering system normally used to reduce the water level and protect foundations of the structures. Sometimes the dewatering system may fail which bring the water level close to the foundation and reduce the capacity of the soil, which contribute to the settlements and displacements of the building. So that stress re-distribution occurred in the building, and it may cause cracks and eventual failure of the building if such precaution is not considered at the time of design.

The conventional designs of structures idealize the points of contact between foundation and soil as pin and tie beams, or fixed. This design will not allow any displacement of the connection. However, in reality the situation is completely different because settlement and displacement will be happened under different type of loadings. Consequently, redistribution of stresses requires analyzing the building under loads and displacements effects. Other type of external loading is the change in the soil property due to dewatering, which happen usually on Saudi Arabia. Watering and dewatering will affect the soil properties, so that flocculation in the displacements could happen, and stress re-distribution will take place in the structure members.

This work focused on the use of Structural Analysis Program (SAP 2000) to analyze buildings subjected to dewatering probable failure in the dewater system. The interaction between the ground and the building (footing) modeled as springs. The footings presented in their dimensions and carried by springs, the spring's stiffness represented the capacity of the soil, which allows displacement in the footing, and the final stresses in the structure members under loading and the corresponding displacement conditions.

Self-Compacting Concrete Utilizing Local Material-Literature Review and Preliminary Research

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Abstract

Self-compacting concrete have recently been an important part of high performance concrete research and application. This is due to its workability, mechanical property and durability characteristics. Different from conventional concrete, the self-compacting concrete is in need of high quantities of fine which is supplemented through the addition of mineral admixtures such as natural pozzolan (NP), superplasticizers and viscosity-modifying admixtures. An artificial neural network (ANN) is a member of computational intelligence model which is inspired by the structure and/or functional aspects of biological neural networks. Several disciplines have embraced its use to model diverse behaviors in different materials, reinforced concrete inclusive. In order to understand the corrosion resistance characteristics of Self Compacting Concrete (SCC) utilizing NP, this study investigated the role played by computational intelligence models such as ANN to predict the time to initiation of corrosion of the embedded reinforcement. The ANN models can be designed by numerical-learning-based algorithms to approximate virtually any nonlinear function with high degree of accuracy. This study will attempt to model corrosion potential of concrete utilizing NP as a part of cementitious material. During the experiment, the corrosion potential of the reinforcement used in the self-compacting concrete for different percentages (10, 15, 20, 25 and 30%) of natural pozzolan was measured. In the modelling approach, the time interval and the corrosion potential measured for any four mixtures are used as input to predict the corrosion potential for the remaining mixtures. The developed ANN models predict the measured values adequately. The correlation coefficient of the experimental data and the model output was around 0.99. The mean absolute percentage error for one of the models was only 4.7%.

College of Industrial Management

KFUPM Library Information System: A case Study

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Abstract

Chemical Engineering Department

CO_2 Flooding Monitoring Model Using Material Balance Equation

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Abstract

CO_2 injection has been widely applied for EOR purposes. For the successful operation of CO_2 flooding process there is strong industrial need to develop models from different perspectives to provide valuable and complementary insights into the reservoir performance during CO_2 flooding process.This study has developed a monitoring and predicting model using material balance equation (MBE) to use field injection data and production data. In order to accurately account for complex displacement process involving compositional effect and multiphase flow, the PVT properties of reservoir fluids and four phase relative permeability relationships are in the model. In the present work several factors have been investigated, such as CO_2 partition ratio in reservoir fluids, possibility of free CO_2 gas cap, proportion of reservoir fluids contacted by CO_2, oil relative permeability improvement when mixing with CO_2 etc. Proposed MBE model is an effective to analyze/ monitor the overall reservoir performance in tertiary recovery process.

Styrene as a promoter, modifier and copolymer in ethylene polymerization

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Abstract

Polyethylene is one of the main products of petrochemical industries in Saudi Arabia. The increase of the production of this valuable commodity polymer is a strategic goal for both the local and global petrochemical companies. This study succeeded in giving solid and clear methodology to five fold increase in the production of high density polyethylene (HDPE). Moreover, this work shows various conditions to produce different grades of polyethylene with specific properties. The results of this study are supported by state of the art characterization techniques to prove our findings. The key factor in this study is to use styrene as a promoter, as a modifier to polyethylene properties or as a copolymer

Ethylene was synthesized using two catalytic systems namely Cp_2ZrCl_2 (**A**)/MAO, and $C_{20}H_{18}Cl_2SiZr$ (**B**) /MAO with various styrene concentration and reaction conditions. Crystallization analysis fractionation (CRYSTAF), DSC, FTIR and ^1H NMR spectroscopy were used for characterizing the synthesized polymers. Low concentration of styrene was able to increase the activity of $C_{20}H_{18}Cl_2SiZr$/MAO and Cp_2ZrCl_2/MAO catalyst systems at particular reaction conditions **.**Three types of polymer were synthesized.

(1) In presence of small amount of styrene and at high pressure, the activity of Cp_2ZrCl_2 increased about five times and the resultant polymer is normal high density polyethylene with excellent properties.

(2) In presence of small amount of styrene and at low pressure the activity of Cp_2ZrCl_2 increased and resulting polyethylene homo polymer have different properties as synthesized without styrene. In this case, styrene worked as both promoter and modifier for the PE properties.

(3)For the second catalytic system ($C_{20}H_{18}Cl_2SiZr$) the presence of small amount of styrene increased the catalyst activity and the produced polymer was copolymer of styrene and ethylene. In this case styrene worked as both promoter and copolymer.

Kinetics of Toluene alkylation with methanol catalyzed by HZSM-5, ZM13 and MOR/ZSM-5 zeolites

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Abstract

Kinetic study of toluene alkylation with methanol was performed over three zeolite catalysts: HZSM-5, ZM13 and hybrid MOR/ZSM-5. Experimental runs were carried out using a fluidized bed reactor at temperatures of 300, 350 and 400 °C and reaction times of 3, 5, 7, 10, 13, 15 and 20 s. Based on the results obtained, a simplified power law kinetic model consisting of three reactions was developed to account for the overall transformation of toluene. Coke formation on catalysts was evaluated using both time-on-stream and reactant conversion decay functions. All parameters were estimated based on quasi-steady state approximation. Estimated kinetic parameters were in good agreement with experimental results. Alkylation of toluene is most favorable on ZM13 due to combined effect of mesoporosity induced by synthetic route and acid content. Toluene/MeOH molar ratio relatively determines the reaction pathway, alkylation rate increases as toluene becomes the limiting reactant i.e. presence of excess MeOH.

RECYCLING OF MIXED PLASTICS WASTE CONTAINING POLYETHYLENE, POLYVINYLCHLORIDE AND POLYETHYLENE TEREPHTHALATE

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Abstract

This research work was undertaken to investigate the spectroscopic, morphological and rheological properties of polymer blends made of recycled Polyethylene terephthalate (PET), Polyethylene (PE) and Polyvinylchloride (PVC). Different blends of these polymers were made by varying composition of PET. Each recycled blend consisted of recycled polymers and ethylene propylene diene monomer **(**EPDM) as a compatiblizer. Spectroscopic and morphological characteristics of recycled polymer blends were investigated using Fourier Transform Infrared Spectrometer (FTIR) and Scanning Electron Microscope (SEM) respectively. SEM analysis revealed low miscibility among these three polymers. While rheological properties were investigated using Melt Flow Indexer (MFI). The rheological characterization indicated that melt flow index (MFI) decreases with increase of PET concentration in PE/PET/PVC recycled blends. It was also inspected that with increase of PET contents recycled blends show pseudoplastic behavior.

Efficient Implementation of Tap Delay Line Filter Using High Speed DSP

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Abstract

An efficient implementation of the linear Finite Impulse Response (FIR) Filter has been performed over the Texas Instrument (TI) TMS320C6416 fixed point Digital Signal Processor (DSP) platform. The implementation fully exploits the pipelined architecture of the processor along with the circular buffering to gain the speed factor of 7 times than the reference approach hence making this more suitable for high speed real-time signal processing applications involving tap delay line (TDL) model.

Amplify and Forward Relay System with Co-Channel Interference over Rayleigh/Nakagami-m Fading Channels

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Abstract

In wireless networks, having multiple antennas at a mobile station is impractical due to the size requirements and power consumption it needs. Instead, the space diversity can be achieved by using one or multiple relays to help the source node in sending its signal to destination node. This is known as cooperative or relay networks. A lot of work has been conducted on the performance of such systems under the condition of noisy relay and noisy destination. As we know, in wireless systems and networks, an important impairment is the co-channel interference. This problem arises as a result of sharing the same channels between the system users. Based on the operation conditions, the interference effect can be considered at the relay node, at the destination node, or even at both. In this work, we consider the impact of interference on the performance of amplify-and-forward relay systems and networks. More specifically, we will consider a fixed-gain dual-hop amplify-and-forward relay system with interference at the destination node over Rayleigh/Nakagami-m fading channels. We also propose to derive the cumulative distribution function of the end-to-end signal-to-interference plus noise ratio. In addition, we propose to evaluate the outage probability and the symbol error rate of the whole system. Furthermore, we will offer more insight about the effect of interference and other system parameters on system performance at the high signal-to-noise ratio regime. We propose to generate some Monte Carlo simulations in order to validate the achieved analytical results. Finally, we will give some numerical results to evaluate the system performance and to illustrate the effect of interference on the overall behavior.

A New Switch-and-Examine Selection Scheme for Amplify-and-Forward Cooperative Network

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Abstract

The virtual array in wireless systems or networks is a powerful tool to achieve space diversity. In order to get rid of the impracticality issue of having multiple antennas at a mobile station, the antennas of other users in a wireless system are used to provide diversity for a desired user. Sometimes, a relay or a number of relays are used to help the source node in sending the signal to the destination node. This is known as cooperative or relay networks. In such systems, several schemes are used nowadays to select among the cooperating relays. An important drawback of such schemes is their high complexity. This is due to the need of estimating the channels of the relays continuously. In this work, we propose a new low complexity relay selection scheme for dual-hop cooperative networks. This scheme is known as switch-and-examine relaying. In particular, we will consider a channel-state information-assisted amplify-and-forward relay network in our analysis. We propose to derive some statistics of the end-to-end signal-to-noise ratio, the probability density function and the cumulative distribution function. In addition, we propose to evaluate the outage probability and the bit error rate of the whole system. These measures will then be used to evaluate the system performance and to prove the effectiveness of the proposed scheme to be used in systems where the complexity issue is the first priority.

Robust Blind Spectrum Sensing for Cognitive Radio

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Abstract

Cognitive Radio (CR) has emerged as a smart solution to spectrum bottleneck faced by current wireless services under which licensed spectrum is made available to intelligent and reconfigurable secondary users. Spectrum Sensing (SS) has been identified as a fundamental enabling technology for next generation cognitive radio oriented wireless networks. This work identifies the performance limits of SS based on Energy Detector (ED). ED which is optimal for detecting Independent Identically Distributed (IID) primary signals is analyzed under noise uncertainty specifically when the received signal to noise ratio (SNR) is considerably low. It has been identified that ED is not robust to noise uncertainty and its performance degrades for correlated primary transmissions. An eigenvalue based sensing to combat noise uncertainty problem in a non-cooperative network is proposed. A sample covariance matrix is calculated from a limited number of received signal samples and variety of algorithms have been analyzed to compare the performance of different test statistics based on eigenvalues of received sample covariance matrix. Since the covariance matrix catches the correlations among the signal samples, the proposed method outperforms ED for correlated signals. Simulations based on IID primary signals are presented to verify the robustness of Eigenvalue Based Detection (EBD) and compare its performance with conventional ED.

Application of Tagged User Analysis (TUA) to Stability Analysis of Slotted ALOHA over Frequency Selective Fading Channels

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Abstract

Tagged user analysis (TUA) is a simplified approach to analyze the multi user system for random access protocols having finite buffer capacity. Analysis has been done using TUA for the performance and stability of buffered SALOHA protocols under ideal channel. In this paper the stability analysis for slotted ALOHA system has been extended to multipath frequency selective fading environment. The operating range for permission probability to achieve optimum system performance is derived. For the finite buffer capacity system the equilibrium point is studied for the selection of the channel access probability that gives best system performance.

Post-compensation of Transmitter's Non-Linear Distortions at the Receiver Using Compressive Sensing Techniques for OFDM Applications

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Abstract

OFDM – due to its many benefits – has become quite popular today. However, its high PAPR, which causes distortion at the output of the power amplifier, has been the problem at the center of much research done to either avoid or correct this distortion. These attempts have been almost exclusively focused at the transmitter. This work stands out as we attempt to correct the distortion at the receiver instead (which would especially be of benefit in cases where the transmitter should be kept simple as we are now able to move complexity in non-linearity compensation from transmitter to the receiver). We do this by employing a number of algorithms based on Compressive Sensing (CS) improve upon the basic CS algorithm using a Data-Aided Iterated version and then, Least Squares to further improve the estimate of the distortion. Another peculiarity of this work is our use of actual, real-world amplifier models and not the overly-simplified models common in previous works.

A Novel Approach for Spectrum Sensing using the Wavelet Transform

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Abstract

To mitigate the issue of spectrum scarcity, the Cognitive Radio (CR) technology has gained a lot of popularity among researchers in recent times. However, the accurate detection of holes in the spectrum is still a very challenging task. In this work, we discuss the power of the Wavelet Transform in sensing spectrum using an edge-detection approach. The simulation results show that the Wavelet transform is robust and computationally efficient in wideband spectrum sensing. It allows the CR to quickly and accurately identify the number of subbands within the interested wideband. Finally, using a simple estimator, PSDs of each subband has been calculated.

On the Use of Blind Source Separation for Peak Detection in Spectrum Sensing

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Abstract

Performing spectrum sensing using wavelet edge detection technique provides us with edges (peaks) which contain information regarding start and end location of a frequency band. In the presence of noise there is a mixture of true peaks and noisy peaks. Knowledge of noise variance is required to extract true peaks efficiently from mixture. In this paper true peaks detection is performed using blind source separation. Probability of detection and success ratio plots are used to evaluate the proposed technique. Success ratio plot shows improvement of 4 dB and probability of detection plot shows improvement of 8 dB. Moreover, the proposed algorithm is based on the received signal without the need of any apriori information.

Spectrum Sensing using Sub-Nyquist Rate Sampling

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Abstract

Efficient utilization of radio spectrum has gained recent attention. It has been observed that utilization of spectrum by licensed wireless systems, for instance TV broadcasting, is quite low. Current static frequency allocation schemes cannot cope up for ever increasing data rates. Some frequency bands are overcrowded and some are barely used. Cognitive radio (CR) seems a tempting solution to resolve the perceived bandwidth scarcity versus under-utilization dilemma. Cognitive radio use spectrum sensing (SS) to sense the frequency bands that are unoccupied by licensed users and transmit on these bands to avoid harmful interference to licensed users. A number of different methods are proposed (in literature) for identifying the presence of signal transmission by licensed user such as energy-detector based sensing, waveform-based sensing, cyclostationarity-based sensing, among others. In wideband regime high sampling rate creates additional burden on hardware devices and put constraints on these algorithms. A solution to spectrum sensing problem based on Sub-Nyquist rate sampling is provided in this work. Structure based Bayesian sparse reconstruction algorithm is used to perform spectrum sensing.

Practical Implementation Of Compressive Sensing To UWB Signals

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Abstract

Compressive sensing (CS) is proposed by many researchers as a solution to the formidable sampling requirements of the promising Ultra wideband technology (UWB). Previous research was evaluated by simulating the IEEE UWB channel model. This research studies the behavior of compressive sensing for practical UWB signals and proposes approaches to enhance the signal reconstruction performance. Four practically-based dictionaries are proposed to increase the sparsity of the realistic UWB signals. Those dictionaries accounts for the practical effects of the channel like pulse dispersion and the unavoidable effects of the antenna directivity. Both measured data and a more practical directional model are used for evaluation. It is shown that CS based on the new dictionaries is able to reconstruct the practical UWB signals more efficiently with reasonable complexity.

Diffusion Particle Swarm Optimizer for Wireless Sensor Networks

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Abstract

A distributed parameter estimation technique using particle swarm optimization (PSO) algorithm is presented in this work. In the proposed algorithm, every sensor node of a wireless sensor network is equipped with a particle swarm optimizer to estimate the best position of the particle in its search space. Using the proposed diffusion scheme the estimated best position of the particle and the corresponding particle fitness value is shared with its neighboring nodes and then the shared information is used to improve the particle best position at the sensor node. Thus the performance of the wire- less sensor network (WSN) using diffusion PSO algorithm is improved by exploiting the spacial diversity of the network and collabratively estimating the parameters. The distributed network is able to adapt to the changes in the environment due to the cooperative and distributed nature of the algorithm. The simulation results show better performance of the diffusion particle swarm optimization algorithm when compared to diffusion least-mean- squares (LMS) algorithm, diffusion Recursive-least-squares (RLS) algorithm and non-cooperative PSO algorithm at same convergence rate.

Direct Blind MMSE Channel Equalization Based on Second-Order Statistics

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Abstract

A family of new MMSE blind channel equalization algorithms based on second-order statistics is proposed. Instead of estimating the channel impulse response, we directly estimate the cross-correlation function needed in Wiener–Hop filters. We develop several different schemes to estimate the cross-correlation vector, with which different Wiener filters are derived according to minimum mean square error (MMSE). Unlike many known subspace methods, these equalization algorithms do not rely on signal and noise subspace separation and are consequently more robust to channel order estimation errors.

Diffusion Normalized Least Mean Squares Over Wireless Sensor Networks

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Abstract

Recently, distributed adaptive algorithms have been proposed to solve the problem of estimation over distributed networks. In a diffusion protocol, each node in the network function as an individual adaptive filter whose aim is to estimate the parameter of interest through local observations. All the estimates obtained from the nodes are then locally fused with their neighboring estimates in the network. The aim of this work is to improve the signal processing capability of the distributed network in a novel way by applying the diffusion -NLMS algorithm. The simulation results will show that the diffusion -NLMS algorithm outperforms its counterpart the diffusion LMS algorithm for slowly changing environment, where data are expected to show high correlation.

Fast Analytical FIR Maximally Flat Notch Filter Design

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Abstract

A notch filter is a filter that contains one or more deep notches or ideally perfect nulls in its frequency response characteristics. The problem with the FIR notch filter is it has ripples in the pass band when bandwidth is reduced. This paper reproduces a technique that will give a maximally flat, finite impulse response notch filter with narrow band scenario.

A Low-Voltage and Low-Power Current-Mode Logarithmic Circuit Design Using MOSFETs

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Abstract

A new low-voltage and low-power current mode CMOS logarithmic function circuit is proposed. The introduced circuit is capable of performing and and its design is based on MOSFET operating in subthreshold region and exponential Taylors series expansion. The circuit is operating from 500mV DC power supply and consumes an ultra low power. The functionality of the circuit is confirmed using HSPICE with 0.35?m 2p4m CMOS process technology.

A Novel CMOS Logarithmic-Control Variable-Gain Amplifier (LCVGA)

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Abstract

This article presents a novel current-mode building block for analog signal processing, namely logarithmic-control variable-gain amplifier (LCVGA). It consists of two Operational Transconductance Amplifier (OTA) and two PMOS transistors biased in weak inversion region. The circuit operates from 0.6V DC power supply and consumes 0.6 µW. The linear-dB controllable output range of 43 dB with maximum error less than 0.5dB. The functionality of the proposed design was confirmed using HSPICE in 0.35µm CMOS process technology. This circuit is expected to be a useful building block for analogue signal processing applications.

Electromagnetic modeling of Optical waveguide amplifier with Si-NanoCrystals as gain medium using ADE-FDTD method

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Abstract

In this work spatio temporal dynamical analysis of Si-Nano Crystal as gain medium is done using ADE-FDTD (Auxiliary Differential Equation- Finite Difference Time Domain) method. The nonlinear properties of the medium are simulated using four level rate equation model. The quantum mechanical material and electromagnetic wave characteristics are coupled by electromag-netic polarization in ADE-FDTD scheme. The Si-Nano Crystal gain medium will be optically pumped at different pumping rates and the resultant affects on population inversion and spectral response of the gain medium will be studied in the paper.

An Embedded Planar Antenna Array within UAV Structures for Communication Link Improvements during Surveillance Missions

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Abstract

In this work, we present the design of a planar embedded antenna array within the wing structure of an unmanned aerial vehicle (UAV) for enhancing its data communication link. UAVs are gaining importance in both military and civil uses. They are used for surveillance and monitoring that is extremely important in border patrol and monitoring. Also, they can be used for monitoring pilgrims during Hajj seasons. UAVs are low cost and safer than flying actual monitoring/surveillance planes with humans on board. The designed antenna array will operate in the 2.4 GHz band and will have an operating bandwidth that covers the ISM band. This work will investigate the effect of the number of elements of the planar embedded antenna array and the beam angle on the gain values and coverage as well as the HPBW and operating range of the communication link.

A Printed V-Shaped Circular Antenna Array for Vehicular Direction Finding

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Abstract

The design and implementation of a V-shaped 8- element circular antenna array for vehicular direction finding (DF) applications is proposed. The antenna array is designed to operate at 2.45 GHz with a -10dB bandwidth of about 150 MHz, thus covering the ISM band. The antenna was designed on an FR4 epoxy substrate with 0.8 mm thickness and an outer radius of 100 mm. We present the simulation results for two different excitation modes; phase excited and switched operation. A comparison between the simulated and the measured resonating frequency, -10 dB bandwidth and the |S11| characteristics for all the eight arms of the antenna under the switched mode of operating indicate a high correlation between the measured and simulated values. In addition, investigation of the azimuthal radiation patterns for the two modes prove the superiority of the phased excitation mode in terms of higher directive beams at the expense of increased hardware complexity.

UWB Stacked Patch Antenna with Defected Ground Plane

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Abstract

Ultra-wideband (UWB) antennas are widely used in short range low power wireless devices to fulfill its bandwidth requirements. This paper presents a novel stacked patch antenna with defective ground plane to cover all the operating frequency bands from 3.1 to 10.6 GHz. The designed compact (20x34mm) and directional antenna exhibits an -10dB impedance bandwidth of 123%. The optimized reflection response and radiation pattern of the antenna are experimentally verified. Packaging affects of the antenna are also included in the analysis.

Gain Dynamics in Quantum Dashes

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Abstract

Quantum Dashes are difficult to model because of the inhomogeneous gain characteristics due fluctuation in dash size and composition. In this work the Dashes are modeled with coupled rate equations and are solved using with central difference discretization (or leap frog discretization). For the analysis of the gain dynamics steady state parameters are obtained from the central difference discretized solution. And these parameters are fitted in Lorentzian poles which represent the electromagnetic polarization. For the analysis of gain in InAs/InP Quantum Dashes the resultant system is solved using ADE-FDTD method (Auxiliary Differential Equation- Finite Difference Time Domain) .The General algorithm scheme is used for the spatio temporal consistency in the modeled simulator.

A Broadband 1x4 Power Divider with Progressive Phase Shift for Antenna Array

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Abstract

A 1x4 power divider is proposed using Wilkinson power dividers. It consists of a Wilkinson power divider to which two more Wilkinson power dividers are attached to its outputs. Thus a four output power splitter is achieved. At the output ports, metamaterial transmission line (MMTL) is used to create phase shift for broadband operation. The design is simulated for 1.5 GHz – 3.5GHz range and 3 GHz – 6 GHz range on commercially available EM software. It is found that with the proposed method, a phase error of ± 5° can be achieved. Modifications in design are also presented which result in further bandwidth enhancement at the cost increasing the size of device. This is achieved by multi-section Wilkinson power divider. The device can be employed in antenna arrays where progressive phase shift is required. Further modifications in design are presented to make it suitable for use in systems requiring unequal power division. For this purpose, unequal Wilkinson power dividers are used instead of normal power dividers. It is found the phase difference is not effected due to such change thus making it suitable for systems requiring unequal ratio of power at the outputs.

Microstrip Linear Array Antenna with Increased Directivity

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Abstract

Microstrip antenna array with increased directivity is an attractive solution for size limitation in handheld wireless communication devices. In this paper, a 10 GHz linear array antenna is designed, where shorting posts and partial reflective superstrate are used to increase the directivity of the array. Professional simulator is used to optimize radiation pattern and reflection responses of the 7-element array. A maximum directivity of 16.7 dB is observed from this simple design. This corresponds to a directivity enhancement of 55% without considerable affecting other parameters of the array.

Strategic Bidding For Load Serving Entity In Electricity Markets

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Abstract

In this paper, an optimal bidding strategy for Load Serving Entity (LSE) is developed for a pool based double-sided auction electricity market. The market model neglects the effect of transmission constraints on the profit of LSEs. In this market, sealed auction with pay-as-bid (PAB) settlement and step-wise bidding protocols are used. The bidding behaviors of rivals are represented as stochastic variables of normal probability distributions. The problem is then formulated as a multi-objective stochastic optimization model and solved by a Monte-Carlo Simulation and Genetic Algorithm (GA). A numerical example involving Generation companies (Gencos) and LSEs without transmission constraints (first model) is presented for illustrating the essential feathers of the proposed model and method. The effects of retail prices, interruptible prices, correlation co-efficient, risk factor, single block bidding per unit time and three blocks bidding per unit time are also studied in the research.

Impact of Transmission Constraints on Bidding Strategy of a Load Serving Entity in Electricity Markets

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Abstract

The participation of demand side in electricity markets results in optimal pricing which guarantee some benefits like reducing the total supply-side and demand-side costs of meeting demand during critical periods. This article develops an optimal bidding strategy for a Load Serving Entity (LSE) in a pool based double-sided auction electricity market model of an IEEE-30 bus system with transmission constraints. The bidding behaviours of rivals are represented as normal probability distribution functions of a stochastic process. The problem is then formulated as a multi-objective stochastic optimization model and solved by a Monte-Carlo Simulation and Genetic Algorithm (GA). The simulation results show that an LSE while building its bidding strategy must undertake forward contracts with most effective generators to maximize its net profit.

Dynamical Analysis of STATCOM Connected in Single Machine Infinite Bus System (SMIB)

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Abstract

A power system consists of an interconnected system of generators, buses, loads, transformers, transmission lines etc. A transmission line can be represented as a combination of series inductors and shunt capacitors. A power system essentially needs control mechanism to control/ regulate its voltage, transmitted power etc. Conventional methods like Automatic Generation Control (AGC), Excitation control and Transformer Tap-Changer Control etc were used to control over the active and reactive power flow on a given line. With the rapid increase in power demand has resulted in more robust control mechanisms. To meet this requirement, ""FACTS"" devices were introduced. FACTS devices can be broadly be classified as: • Series Compensation: In this case, the FACTS are connected in series with the power system. It works as a controllable voltage source. • Shunt Compensation: In this class, the FACTS are connected in parallel with the power system. It works as a controllable current source. One of the new generations of FACTS devices, which is based on the voltage source converter is STATCOM. The paper will involve a dynamic analysis of STATCOM when it is connected to Single Machine Infinite Bus system in the middle of transmission line. This will include the modeling of the STATCOM device and simulations will be carried out by applying disturbance and then check the robustness of the system with STATCOM.

Transmission Lines Induced Currents in Human Bodies using Charge Simulation Method

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Abstract

This work is aimed to calculate the distribution of the electric fields, surface charges, current charge density and induced currents on a human body standing in the vicinity of High Voltage Transmission Line. The ground plane electric field underneath transmission line is approximately uniform. In the presence of human body this field is highly perturbed due to the charges on the body and may reach eight or ten times higher than the unperturbed (uniform) field. Therefore, accurate calculation of electric field induced currents in the human body is required which can be done by using the enhanced electric field values. Induced Electric field and currents on human body are investigated by varying the height of the lowest conductor of HV Lines and by varying the distance of the body from the center of transmission line. The method of analysis is based on the Charge Simulation technique. The accuracy of the calculated values has been measured by comparing the results with previously published values.

Study on Impacts of Large-Scale Photovoltaic Power Station on Power Grid Voltage Profile

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Abstract

The large-scale photovoltaic (LSPV) power stations are usually located in desert and connect to local power grid through long high voltage transmission lines. Due to the solar irradiance nature, LSPV will impact the voltage profile along the transmission line. Based on power system analysis principle a simple and accurate method is developed in this paper to examine impacts on the Voltage profile of the buses due to the grid-connected LSPV power station. Then, POWER WORLD SIMULATOR (PWS) software package is used to verify the proposed method. The proposed Method presents that Bus Voltage is a nonlinear function of PV power output and have a parabolic curve known as PV curve. Each PV curve has a maximum voltage point which is determined by the impedances. Relation between bus voltage sensitivity and PV power output is also determined which shows that bus voltage sensitivity is also a nonlinear function of PV power output.

Performance Analysis of a Hybrid Intelligent Controller in the Design of PSS for a Synchronous Generator

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Abstract

The potential and effectiveness of a hybrid intelligent PSS controller combining the advantages of both differential evolution (DE) and Tabu search (TS) is assessed in this paper. The controller is incorporated in a single machine infinite bus (SMIB) system with a synchronous generator. The first covers the modeling of the generator, followed up controller design. An analysis is also carried on the quality of results if various parameters of the differential evolution like crossover, mutation and population size of the algorithm is varied. The parameters that are varied give an overview of how the optimized value of the controller varies and the number of iterations it takes to get to the optimized value. At the end a comparison is made between the controller based totally on differential evolution and the one designed with the hybrid technique.

Multi-Objective Particle Swarm Optimization for Optimal Power Flow in a Deregulated Environment

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Abstract

In this paper, a multiobjective particle swarm optimization (MOPSO) technique is proposed for solving the optimal power flow (OPF) problem in a deregulated environment. The OPF problem is formulated as a nonlinear constrained multiobjective optimization problem where the fuel cost and wheeling cost are to be optimized simultaneously. MVA-km method is used to calculate the wheeling cost in the system. The proposed approach handles the problem as a true multiobjective optimization problem. The results demonstrate the capabilities of the proposed approach to generate true and well-distributed Pareto-optimal solutions of the multiobjective OPF problem in one single run. In addition, the effectiveness of the proposed approach and its potential to solve the multiobjective OPF problem are confirmed. IEEE 30 bus system is considered to demonstrate the suitability of this algorithm.

Performance Evaluation Of A Microgrid Including Wind and PV Generation

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Abstract

Extensive increase of distributed generation (DG) penetration and the existence of multiple DG units at distribution level have introduced the notion of micro-grid. Among renewable energy options photovoltaic (PV) and wind generations are most common choices for many utilities. This paper aims at presenting a systematic approach and the mathematical formulations to develop a small-signal dynamic model of a microgrid that includes wind and photovoltaic in addition to conventional small scale generation. The model developed evaluates the amount of generation mix from various DGs for satisfactory steady operation of the microgrid. Also, the factors that could drive the microgrid to the brink of unsafe regions have been identified. It has been observed that the large integration of electronically-interfaced generation units in microgrid environment degrades the voltage quality in microgrid but at the same time due to their fast response they can quickly respond to active power imbalances in the microgrid and can ensure the stability of microgrid and enhance angle stability.

Modeling And Control Of A Microgrid Including Wind And Pv Generation

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Abstract

Large participation of renewable power sources with rapidly varying inputs can disturb the dynamic as well as steady state performance of a microgrid system. The extent of generation mix in satisfactory operation of the system plays a pivotal role. This paper develops a small-signal dynamic model of a microgrid that includes wind and photovoltaic in addition to conventional small scale generation. The model developed is intended to (i) to identify the amount of generation mix from various DGs for satisfactory steady operation of the microgrid and (ii) to identify the factors that could drive the microgrid to the brink of unsafe regions. This paper also proposes a central controller for stabilization and control of the tie-line power flow in microgrid. The potential of various controls available in the microgrid to improve the dynamic performance has been investigated through several decomposition techniques. Both small signal frequency response and nonlinear simulation techniques have been used to identify the unstable regions and proposed controller is then employed to extend the region of safe operation of the microgrid.

Aerospace Engineering Department

A MATLAB Program for the Solution of Generalized Quasi-One Dimensional Compressible Flows with Friction and Heat Addition

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Abstract

In this project, a MATLAB program has been developed for generalized quasi one dimensional compressible flow with heat addition and friction and with or without sonic point inside a variable area duct. The program is useful for many industrial applications which deal with high speed flow variable area ducts like diffusers, shock tubes, exhausts, wind tunnels, rocket engines, etc. The governing equations for generalized quasi one dimensional compressible flow with heat addition and friction are used to derive a set of "influence coefficient" equations which describe the relative change in a flow variable given certain input conditions. The influence coefficient equations are put in a matrix form with the influence coefficients in a form of a Jacobian matrix. The solution of the Jacobian matrix yields expressions for the relative change of all the flow variables which can be solved for a given initial condition. Heat addition is specified in terms of stagnation temperature distribution. The program can be applied to non-planar geometries like cylindrical and spherical shells. With this program variation of Mach number, pressure and temperature throughout the duct can be determined for a given initial conditions which can aid in a better design of variable area ducts.

A Case Study of In-Flight Shut Down of GE CF6-80C2 Engine Oil System due to Fuel-Oil Contamination

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Abstract

The research paper deals with a case study of in-flight shut down occurrence of GE CF6-80C2 engine oil system due to fuel-oil contamination. In one instance, fuel entered engine lube system due to cross connection of PCR tube P/N 1309M64P01 with MEC servo drain line P/N 1383M54G01 at MEC end. The present configuration of the PCR tube and MEC servo drain line are having similar reducer fittings at MEC end. So a remedy has been suggested by introducing adapter plug in fuel/oil heat exchanger, one with clockwise thread and the other with anticlockwise thread. Maintenance practices and performance analyses of oil system has also been done in this project. Onboard flight readings of oil system received from Air India are used to compute performance analysis for oil pressure and temperature for various time periods.

Approach and Landing Accident Reduction Strategy

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Abstract

The paper deals with finding a strategy to mitigate the problem of approach and landing accident reduction especially in the middle-east countries. Initially a research is done to find out the number of accidents happening in the world per million flight hours and per million departures which shows middle-east prone to the highest rate of accidents. The paper progresses with suggesting an engineering solution in terms of autoland systems and then moves on to suggest a management solution in terms of proper crew resource management training for improving situational awareness. Later on future technologies are discussed and their importance of implementation which sums up the overall purpose of the paper to enhance safety and reduce such type of accidents.

Prospect of Public Transport System in Eastern Province of Saudi Arabia –Lessons Learnt from Dhahran, Dammam and Khobar Cities

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Abstract

In last few decades public transport has become the most efficient mode for transportation (for people and goods). Yet in reality, the number of private cars on the road continues to rise, though it well understood that public transport offers better environment along with cheaper coast and shortest route. Every year almost 6.6 millions vehicles are adding to Saudi Arabian Roads. The annual growth rate is more than 5%. Among the total vehicles adding each year, 70.8% are private cars and only 1.1% are buses. On the other hand, every year around 6.1 millions people are adding to the total population since 2004 AD and annual growth rate is around 1.53%. The uncontrolled growth in motorization especially growth of private cars in this country has been contributing to such monopolized car oriented urban transport system, which is socially, economically, and environmentally unsustainable. In most cases, the means of sustainable urban transport system is undermined for managing rapid urban development. Lack of integrated public transport system, subsidized fuel price together with zero import duty on car has made the individuals overly dependent on car as the predominant mode of transportation.

Studying Eastern Province cities this paper aims at developing potential alternatives for individual car-driven transportation by looking at some exemplary cases in the west and east. Special emphasize will be given on the prospect of possible alternative mode for mass transit in the form of Public Bus within Dammam, Dhahran and Khobar cities. This paper will also try to find out probable and effective routing for buses within these three cities.

A Study on Awareness of Nuclear Energy and perception of its Risk in Saudi Arabia: an Educated Learning from KFUPM Community

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Abstract

As nuclear industry is booming again in the era so called 'nuclear renaissance', Saudi Arabia and other countries in the Middle East takes serious interest in nuclearenergy. However, as historic nuclear disaster shows, nuclear energy is a controversial issue among citizens. Therefore it is important to recognize public perception on it.
The study aims to analyze public perception on nuclear energy among Saudi Arabian citizens and expatriates in the Kingdom. To meet the goal of the study within limited time, the study uses online questionnaire with the convenient sampling. The study finds that there are inner conflicts among respondents between economic benefits from nuclear energy and external diseconomy caused from it.

Inexpensive Competitive Public Transportation Solution for Al-Khobar

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Abstract

Post Occupancy Evaluation of Cubicle Workspaces in Architectural Design Studios

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Abstract

The intent of this paper is to assess the user satisfaction, and render the findings of a case study conducted on the performance evaluation of the cubicle workspace of Architectural Design Studio at King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia. This was followed by recommending appropriate actions which eventually would improve the performance of the workspace in terms of maximum user satisfactions. Utilizing the concept of Post Occupancy Evaluation (POE) in assessing the technical, functional and behavioral elements of performance resulted in the review of literature to identify and analyze the aforementioned elements for the workspace chosen. The identified elements were evaluated using questionnaires to assess the user satisfaction with the workspace. Instrumentation techniques for the selected elements (technical – thermal comfort, lighting, and acoustics) were carried out to assess their compliance with respective standards. The findings as a result of this study were then reported and appropriate actions to be taken were recommended. On an average, as a result of questionnaire, the study revealed dissatisfied users from the view point of all the three traditional POE elements of performance (i.e. technical, functional, and behavioral) and the assessment carried out using respective instrument yielded compliance with thermal comfort only. Studio is believed to be a significant learning setting in institutions. The performance of such environment directly or indirectly affects the learning experience and satisfaction of the students thereby affecting their productivity. Thus, assessing the user satisfaction as well as technical measurements within the cubicles in the design studio is helpful to both students as well as institutions.

A Simulation Model for Emergency Evacuation Time of a Library Facility using EACNET4

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Abstract

The purpose of this article is to present the findings of a case study to simulate the optimal emergency egress time for the main library of King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia, using the evacuation simulation model – EVACNET4. FPETool has been used for validation of the egress time confirmed by EVACNET4. Literature pertaining to emergency evacuation was analyzed by the authors and was then utilized to determine the input information to EVACNET4. This was followed by the preparation of the facility's network model in EVACNET4 through giving the node and arc information as the input. Similarly, input information was calculated and supplied to FPETool to validate the result generated by EVACNET4. The study revealed that the evacuation times obtained using both EVACNET4 and FPETool for the library are different and vary 49 seconds in magnitude. This study could be of practical help to facilities manages from the view point of emergency evacuation planning in specific facilities, and to architects during the process of designing the spatial layout of the library facility, where even minor changes in the layout can have large impacts on egress time.

Effective Window Design for Reducing Solar Heat Gain

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Abstract

This paper investigates the thermal performance of exterior overhangs of windows located in student housing, also Parametric study was carried out to determine the performance of solar glazing with in Saudi Arabia The most effective way of preventing heat gain in buildings is by shading the sun before it heats the glazing. Interior blinds, drapes, and window film block the radiation after it penetrates and heads to the glazing. Exterior shading can block up to 90% of the sun energy before it heats the window, dramatically reducing the heat gain and load on the air conditioning system. During the study it was found that by changing the dimensions of exterior overhang solar heat can be block to an extent. By increasing the Depth of External shading, the overall solar heat gain can be reduced for all orientations. Here in this research it has been found that when the depth of external shading is doubled and single glazed window is replaced by double glazed window then Percentage Solar heat reduction for window on north is 54%, for East orientation 69.99%, for west 86.66% and for South 69.99% also it was found that by installing tinted glazings instead of clear glazings the overall consumption can be reduced to an extend that too with low investment cost and payback period.

Assessment of Maintenance Services of Residential Buildings in Saudi Arabia: Needs and Difficulties

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Abstract

Maintenance of residential buildings in Saudi Arabia is facing many challenges which limit its development as a professional filed of practice. The objective of this paper is to identify the common defects that occur in residential projects. The paper will also investigate the difficulties facing the maintenance service in this sector of buildings. Literature review and interviews with concerned parties were conducted to identify the common defects. Then a comprehensive questionnaire was designed and distributed to assess these defects and the priority of maintenance works. The results indicate a variety of defects occurrence. The most common defects are door hinges and locks, poor installation and leakages of sewerage, lights breakdown and paint defects. The questionnaire results indicate that there are also a set of factors that impact on the maintenance services such as technical, financial, social, managerial and spare parts. The main benefit of estimating the residential buildings maintenance problems is to improve the maintenance industry in this section and enhance the overall performance of these buildings.

Investigation of Fire Prevention Measures and Escape Rescue Systems in High Rise Buildings

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Abstract

The objective of this paper is to investigate fire prevention measures and escape rescue systems in high rise buildings. In this research paper a thorough literature review will be conducted in order to investigate the common risk factors associated with fire fatalities, avenues of fire prevention in high-rise buildings, escape and rescue systems in high-rise buildings, evacuation strategies in high-rise buildings, and factors associated with time delays in evacuation process. A case study was studies depending on exterior elevator that installed at the roof of these types of buildings. The outcomes of this paper indicate that high-rise buildings fires are perhaps the most dangerous. Within others, flames and smoke can travel through ductwork, between interior walls, and up elevator shafts and stairwells, so that there is a need to investigate it and find the avenues of appropriate evacuation. This paper will increase the awareness between the designers of the building to include international and local fire codes at the design process like evacuation strategies, and the provides safe escapes.

IMPACT OF BUILDING SYSTEMS DESIGN ON ENERGY CONSUMPTION IN RESIDENTIAL BUILDINGS UNDER HOT HUMID CLIMATE

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Abstract

This research has the following objectives: the first is to investigate the impact of the thermal characteristics of building envelope on energy consumption; the second is to investigate the impact of lighting system Selection, HVAC operation Strategy and interior shading on Energy consumption while the final is o find potential Energy Savings when the building systems are properly designed. A literature review will be conducted in order to study the energy performance of residential buildings in Saudi Arabia, .identification of energy conservation measures, IECC Standards. After that Selection of residential Building by Collecting of Architectural, Mechanical, and electrical drawings, analysis of the collected data and drawings, and identification of possible energy conservation measures, Finally energy simulations using Visual DOE, simulations of the base case residential building, simulation of the conditioned building with Identified energy conservation measures and analysis of Simulation Results. Energy simulation were conducted to find the combine effect of all energy conservation measures, results have shown that altogether 24.1% of energy saving can be achieved. In Saudi Arabia, the bulk of electrical energy in residential buildings is used by mechanical system to achieve thermal comfort. The high energy consumption is mostly related to poor thermal performance of building envelope. Therefore, the study of investigating the thermal performance of building envelope under hot-humid climates in Saudi Arabia will identify some energy conservation measure that could be implemented to reduced energy consumption.

Evaluation of Fire Safety in Design and Operation of Typical Administrative Building Located in University

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Abstract

This paper investigates the safety design practices and operation factors of an administrative building, which is accomplished by carrying out fire inspection in an administrative building located in the university (King Fahd University of Petroleum and Minerals). In order to carry out the inspection of the building, Architectural drawings of the Building were taken from the projects department of the University for the purpose of locating the proximity fire sources and other important safety issues. Various fire safety standards were reviewed, and inspected results of the safety practices in the building were compared with the standards and they were found not to be in compliance with the standards. A set of recommendations were made in the study after inspection in order to make the building fire secured and in compliance with the standards.

Petroleum Engineering Department

An Experimental Investigation toward the Development of a Sustainable Drilling Fluid using Canola Oil

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Abstract

The conventional practice of petroleum industry is to formulate oil-based mud system using No. 2 diesel as the base oil. However, their high toxicity level made them unsustainable for using in many environmentally sensitive offshore and onshore locations globally. The recent environmental legislation and control restriction of the usages of oil-based mud become more stringent in many parts of the world in general, and the Kingdom of Saudi Arabia in particular. For instance, a set of regulations called the Corporate Regulations for Offshore Drilling Operations in Saudi Arabia established by the Royal Decree No. M/9 of November 18, 1987, stipulates that all oil-based drilling fluids that are designated as toxic fluids, and cuttings must be hauled back to an approved onshore disposal site, and that cuttings from oil-based mud should be cleaned using the best practical technology and then be discharged as close as possible to the sea floor. In addition, a recent study shows that the cost to haul a barrel of drilling waste is USD 40, and cost of cleaning one pound of oil-soaked cuttings is USD 25. Therefore, implementation of these regulations will make the overall drilling cost skyrocket. As a result synthetic solvent-based mud systems are being used in the oil industry for drilling. However, these mud systems are not only toxic, but also very expensive too. Hence, the development of a sustainable drilling fluid from natural, biodegradable, environment-friendly oils which satisfy both technical and environmental criteria become inevitable.

This study is an account of the development of two mud systems: An oil-based mud system and a synthetic solvent-based mud system. Complete mud check conducted on them and a comparison between their properties made. Results of measured parameters such as dial readings, PV, YP, Gels, HTHTP filtration loss, electrical stability, and base oil ASTM specification tests show that the developed non-toxic OBM compares favorably with the synthetic-based mud currently being used in offshore location in Saudi Arabian waters. This research will have a positive environmental impact on the petroleum industry's current practices which will eventually make a strong position of Saudi Arabia globally.

Evaluating the Pressure Drop Due to Multi-Phase Flow in Horizontal Pipe Using Fuzzy Logic

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Abstract

One of the most important parameters affecting flow rate in oil producing wells is the pressure drop across the surface flow-lines. The pressure drop calculation in multiphase flow is very complicated due to the empirical nature of the correlations used and the high variation in gas and liquid flow rates across the multiphase flow stream especially in hilly terrain and rough environment resulting in server flow regime and negative impact on well productivity. As the pressure decreases due to the frictional and gravitational forces, more gas comes out of solution. This gradual increase in gas volumes leads to the reduction of liquid slip velocity and creating new flow patterns that are not only different in shape, but also complicated in pressure drop calculations. Scientists came up with two main approaches: empirical/experimental flow correlations and mechanistic models to overcome this difficulty. These two approaches are applicable within certain conditions where their accuracy in pressure drop prediction degrades outside their design boundary ranges. The raising popularity of Artificial Intelligence (AI) techniques during the past two decades proved that AI can be an alternative solution to many of the problems where physics and classic statistics fail to provide satisfactory solutions. These techniques have been applied in different upstream fields and have provided fast, robust and reliable numerical models in a variety of areas, e.g., geological modeling, reservoir engineering, petro-physics and well testing. This paper describes the utilization of Fuzzy Logic, which is one of the industry AI techniques, in predicting the multiphase flow pressure drop in surface pipeline for oil fields using real testing data collected from several Saudi Arabian oil fields. More than 280 published real well testing data were used in constructing the Fuzzy Logic model. After filtering the data and building the model using 179 well data samples, the newly developed AI model was successfully used to predict the multiphase flow pressure drop for additional 60 new samples of rate test data with an average absolute percentage error of 1. A detailed comparison analysis was conducted to evaluate the developed Adaptive Neuro-Fuzzy Inference System (ANFIS) model with the existing horizontal multiphase flow correlations used in the industry. The results confirmed that fuzzy logic is more accurate than all the used correlations where the ANFIS model resulted in 1% absolute average error compared to a range of 17.5% - 64.57 % for the compared correlations.

Effect of Trapped Gas Saturation on Oil Recovery during the Application of Water Flooding

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Abstract
The paper presents the effect of trapped gas during the application of secondary processes, or more precisely, in the period of application of conventional waterflooding of partially depleted oil reservoirs. The production of oil by water flooding can be substantially increased by the maintenance of free gas saturation in the reservoir during the flooding operation. This effect is accomplished by the alteration of oil relative permeability characteristics and the occupation by gas of pore space that would otherwise be filled with residual oil. The amount of reduction in residual oil can be calculated from appropriate water-oil relative permeability characteristics. This paper, also presents experimental data in support of the foregoing conclusions and an example of the calculations.From this study, we can see the effect of the trabbed gas on the improvement of the recovery and the evidence that in some cases it is better to produce below the bubble point to benefit from the concept of mobile and trapped gas.

New View for Predicting the Gas Compressibility Factor and a New Model

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Abstract

Gas compressibility factor (*z*-factor) is an important parameter widely used in petroleum and chemical engineering. Accurate and fast calculation of this parameter is of crucial need and challenges a large number of simulators used in petroleum engineering.

The Standing-Katz chart was published in 1942 and since then has been considered an industry standard. Several methods have been tried and developed to calculate *z*-factor by fitting models on the smoothed Standing-Katz data. Some of these models are the Dranchuk and Abou-Kassem (DAK), the Nishiumi-Saito, the Nishiumi, Hall-Yarborough and the Brill-Beggs correlations. All models developed afterwards the Standing-Katz charts present some limitation like instability close to certain boundaries, convergence, and/or accuracy.

In fact, different correlations tend to fit better to a particular area of the domain for*Ppr*and*Tpr* (pseudo-reduced pressure and temperature), but fail badly close and beyond to their limits. Also, most correlations require iterative procedures to obtain the corresponding *z*-factor, and may even present different results dependent on the initial guess for the initial iteration. The DAK correlation is one of the most widely used models.

In this study we describe the utilization of Neural Networks(Back Propagation method), which is one of the famous AI techniques as low error methodology to obtain *z*-factors for Natural Hydrocarbon .Data used for constructing the Standing-Katz and Katz compressibility charts were used in constructing the neural networks model. After building the model using 70% data for training , 15% for validation and it was successfully able to predict *z*-factor for the 15% new samples of data with an average absolute percentage error of 0.197 , and it is better than DAK correlation with total average absolute percentage error of 0.307.

Also, this research provide the industry with a mathematical model obtained from the weights , biases and the transfer function used in Ann. The results provided by this mathematical model are the same as we get from ANN. So, we can convert any ANN to a visible mathematical model.

Impact of Drilling Fluid Sand Content on Filter Cake

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Abstract

In overbalance drilling, the invasion of drilling fluid particles and filtrate into the porous formation around the well bore has long been identified as one of the major factors contributing to reducing the productivity in oil and gas wells. The physical and/or chemical change to the formation rock in this zone is commonly referred to as formation damage. The volume of filtrate has a significant consequence on the extent of formation damage. The formation damage is generally evaluated in API or HPHT static or dynamic filter press experiments duplicating as close as possible the actual borehole conditions. Fundamentally the filtration volume is a function of drilling fluid composition, filter cake properties, filtrate character, wellbore conditions and formation parameters.

Two invasion mechanisms are notable, the first mechanism occurs due to positive difference between the drilling fluid and formation pressure while the fluid pumping is stopped, called static filter cake build up. The filtration rates are controlled by the rapid filter cake growth and its permeability. Dynamic filter cake build up is the other mechanism which occurs while the fluid is being pumped through the well. The dynamic filtration reaches equilibrium where the solids particles deposition rate and the erosion rate due to the share stresses generated by the fluid flow in the well bore are equal. Thus, the filtration rate and cake thickness remain constant. In general, the mud cake basically seals the formation and stops the filtration rate.

Both static and dynamic deposition mechanisms of filter cake build up over the surface of permeable formation and their influence on the cake characteristics will be reviewed in this paper. The paper will also summarize the results of an experimental and theoretical study on filter cake characterization by different methods. The objective of the study is to gain insight about the filter cake and how these distinct techniques can enhance our understanding about its character. It also will give an overview on the most important filter cake properties like thickness, permeability and porosity that are controlling the filtrate volume.

At the end of this paper, several drilling fluid samples, collected from the oil field while drilling a sandstone formation. These drilling fluid samples are collected at different times, having different sand content, and are used to study the relationship between the sand content in the filter cake and its thickness. The results show that the filter cake thickness is related to the percentage of sand particles in the filter cake.

Prediction and Comparison of Well Deliverability in Tight Gas Sands Using Different Hydraulic Fracturing Schemes

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Abstract
Tight gas sand reservoirs are unconventional energy resources that are difficult to produce and optimize using conventional methods. With the increase in demand, high gas prices and the advancement in technology tight gas reservoirs have become the center of interest for the petroleum industry. Tight gas reservoirs require expensive technologies and techniques like hydraulic fractured vertical and horizontal wells for development and optimum gas recovery. To make investments confident very rigorous well/reservoir modeling is required taking care of all uncertainties. Long term changes in well/reservoir behavior are also modeled as long well life is expected in tight sand environment.

In this paper different well options have been evaluated i.e. vertical well, vertical hydraulically fractured well and transverse fractured horizontal well using field data. Productivity prediction, comparison and sensitivity analysis for all schemes have been carried out with analytical and simulation approach (Eclipse environment). Analysis has been done considering transient flow conditions because in tight gas reservoirs pseudo-steady state is achieved after a large time period, as is not the case with conventional reservoirs. Comparison between different options has been made on initial production. Fracture modeling has been done using 3D Geometric Local Grid Refinement.

The results showed productivity performance enhancement under stimulation conditions, i.e. the reservoir which could not produce economically under unstimulated conditions produced economically when hydraulically fractured, comparison with multiple hydraulically fractured horizontal well showed further enhancement. This study also provides insight on production optimization of production performance in tight gas reservoirs.

Analysis of Empirical Correlation of the Viscosity of Formation Brine

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Abstract

Values of reservoir brine properties are often needed for various petroleum engineering operations like water flooding and production when laboratory PVT data are not available. Accurate knowledge of the physical properties of water under the influence of temperature is important for predicting behavior of reservoirs containing brine or geo pressured-geothermal aquifers. This study involves an evaluation of literature information on dynamic viscosity of brine and comparison of the correlation results with measured values. Correlations for dynamic viscosity proposed earlier were found to give large variations among correlated and experimental values. To address this, an attempt to develop an improved correlation with fewer errors by directs method was proposed and statistical comparison between them shows that the newly developed correlation of this study outereprforms all the existing correlations.

Capillary Pressure vs. Water Saturation Relationship for Low Permeability Gas Shale Reservoirs

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Abstract

Knowledge of reservoir porosity, permeability, and capillary pressure is essential to exploration and production of hydrocarbons. Although porosity can be interpreted fairly accurately from well logs, permeability and capillary pressure must be measured from core. Estimating permeability and capillary pressure from well logs would be valuable where cores are unavailable.
This study presents results of a laboratory study of capillary pressure characteristics of core samples from the Bossier sands in the Mimms Creek Field located in Freestone Co., TX. The Bossier tight gas sand play is believed to be part of a basin-centered gas system (BCGS) in the East Texas Basin. Capillary pressures measured were later compared with a centrifuge to fully define the pressure-saturation range observed in the Bossier sands using a centrifuge.

Also presents a practical assessment of petro-physical properties of shales and their measurement in the lab and via logs. Gas-bearing shale present unique measurement challenges due to their ultra-low permeability and complicated pore volume connectivity. Given their economic significance, there is a strong drive to understand gas shale petro physical property measurements, both in the laboratory and in the subsurface. The various core analysis protocols are used in different laboratories leading to physical property measurements that are inconsistent, even when measured on identical sample sets. In addition, log analysis of kerogen-rich shale is 'unconventional' compared to classical techniques used in tight gas sands. In reviewing these practices, the need and possible direction of new technologies that will be required for making evaluations more accurate and quantitative in the future are also discussed.

A New Correlation for the Viscosity of Formation Brine

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Abstract

Water invariably occurs with petroleum deposits. Thus, accurate knowledge and correct application of the properties of water under reservoir conditions are important to Engineers. One of such property is the viscosity of the Brine. The dynamic viscosity of water is often required for Reservoir and Petroleum Engineering calculations. Laboratory PVT data are usually unavailable, and so the need arises to utilize developed correlations to predict the required brine property.

Many correlations have been developed for the formation brine viscosity, some have been developed directly as a function of Temperature, Salinity and Pressure, while some have developed correlations for Pure Water first and adjusted with a correction factor for salinity effects. In this project work, a comprehensive review of both Pure Water and Formation brine viscosity models have been done, statistical error evaluation have been performed on them, and new correlations with lesser errors have been developed. The new Formation brine model was obtained by developing a new pure water viscosity correlation and then adjusting it for salinity effects. The performance of the resulting models was then ascertained by comparing the errors obtained with that of the existing correlations. Results indicate that they outperformed all other existing correlations. Average Absolute errors of 0.0429% and 6.04% were obtained for the Pure Water and Formation brine equations respectively, and the resulting number of constants for the Formation brine viscosity correlation was also lesser than those of the existing correlations.

A Numerical Investigation of Wettability Alteration during Immiscible CO_2 Flooding Process

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Abstract

Wettability has been recognized as one of the controlling parameters of the remaining oil-in-place. The knowledge of wettability alteration is essential to understand the displacement mechanisms and to recover oil efficiently. Continuous alteration of wettability and other related properties need to be addressed properly for an effective approach to enhance oil recovery significantly. Literature review showed that extensive research was devoted to laboratory experiments including core and micro-model flooding to investigate wettability alteration during CO_2 flooding. However, limited research on numerical and/or analytical modeling was reported where continuous alteration phenomena are addressed properly. Moreover, to the best of our knowledge, published numerical and/or analytical models and their solutions are time-independent. Ignoring this important time dimension creates a significant knowledge gap on the numerical and/or analytical modeling and their solutions in reality. To mitigate the shortcomings associated with the existing modeling approaches, A novel way of determining the Corey relative permeabilities of the oil and CO_2 phases as functions of wettability was developed to handle wettability alteration continuously during CO_2 flooding process. A two-phase immiscible simulation model was built numerically utilizing MATLAB program. This study showed that the inclusion of wettability alteration is very influential parameter in enhancing oil recovery and sweeping the reservoir efficiently.

Effect of Nano-Silica on the Rheological Properties of Portland Saudi Cement Type 'G'

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Abstract
Silica products have been introduced long time ago and used in several fields that requires cementing operations [1]. Their ability to improve cement properties and to sustain cement strength in high temperature application has made them a favorable mixture with cement. [2, 3]

This paper presents the effect of Nano Silica on the rheological Properties of Portland Saudi cement type G with a real field mixture and additives used from a well in the Middle East. Rhoeolgy testing was conducted at Temperature of 196° Fahrenheit and slurry density of 125 Pound per cubic feet (pcf). Different Nano Silica Percentages were added with Silica flour and Silica Sand and other chemical additives. Static gel strength testing was conducted at final temperature of 290° Fahrenheit and pressure of 4666 pound per square inch (psi). Analysis of the effect of Nano silica on the plastic viscosity, yield point, and gel strength will be presented with a recommendation of the optimum silica percentage to be used.

Furui's IPR Model Correction and its Application in Horizontal Well Cresting & Inflow Control Device Installation

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Abstract

The problem of reservoir heterogeneity has made the continued use of Inflow Performance Relation (IPR) models developed on the assumption of homogeneity impractical. Furui in 2003 (and previously Butler in 1994) solved the problem using fully penetrating well idea so that the model can be applied to different sections of the reservoir.

This paper corrects two errors in Furui's model. The first error is the use of arithmetic mean of radii to evaluate the elliptic surface area of the well when an anisotropic reservoir is converted into an isotropic equivalent. This was corrected using an equivalent cylindrical surface area. The second error is the use of a planar isobaric surface at the end of the radial flow region instead of a circular one. These corrections gave the model a better performance-average of 99% against 96% by the original version, when compared with line source solution obtained by using Green function.

Equating the hydrostatic and viscous pressure differences between the well and the water oil contact (WOC), a cresting equation that predicts the critical production rate and pressure drawdown for each zone needed to prevent water (or gas) encroachment was developed.

Based the IPR and cresting equation, this work presents a mathematical concept on installation of Inflow Control Device (ICD) so that production from each zone is designed according to its requirements.

Mechanical Engineering Department

Development of Continuously Operating Solar Powered Refrigeration System

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Abstract

The air-conditioning and refrigeration systems in the KSA consume more than 60% of the electrical energy consumption of the building sector. Most of the used systems are of the vapor-compression type. Using solar energy to power such systems will save a large amount of energy (primary or electrical) that can be utilized by the production sectors such as the industry. Hence, the objective of this study is to develop a continuously operating fully solar- powered absorption refrigeration system that can provide a 24-hour service of refrigeration and/or air-conditioning. The development includes an in-depth review of the design and operation of the conventional and solar-assisted absorption refrigeration systems coming-up with new alternative designs, detailed thermodynamic analysis of some of the new alternative designs and selection of the most suitable alternative design. The alternative designs have been developed and analyzed to meet the design objectives. The analysis indicates that single stage aqua-ammonia absorption system with refrigerant storage is the most suitable alternative design for a totally solar powered day and night operation of a refrigeration system.

Evaluation of the effective thermal conductivity of the CNT based polymer composite

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Abstract

Carbon nanotubes (CNTs) have been extensively studied due to their outstanding physical properties such as high Young's modulus, electrical and thermal conductivities. The high thermal conductivity of CNT make them of great importance to the scientists and engineers, as they can be used in a number of applications ranging from nanoprobes, field electron emitter, hydrogen absorber, nanotweezer, nanobearing, and so on. Recently, a lot of study has been carried out to successfully utilize the properties of CNT's in polymer based composites. These studies have shown that the CNT embedded composite has excellent conductive properties and is one of promising materials which can be used for production of miniature devices managing heat transfer. Most of the studies carried out on the evaluation of thermal conductivity have been based on experimental or analytical work. We will in this report focus on the numerical based approach to find the effective thermal conductivity of polymer composites embedded with CNTs. Our focus is to find the effective thermal conductivity of the CNT based polymer composite using the available Finite Element software ANSYS with its current capabilities.

Our aim in this analysis is to evaluate the effective thermal conductivity of the polymer composite filled with CNTs. The effect of variation of aspect ratio of the CNT and also the volume fraction on the effective thermal conductivity of the RVE has been investigated.

An initial study was conducted with the ANSYS involving all three materials i.e. CNT air and polymer but this approach has a certain limit. Since the air is supposed to be trapped between the CNT we have to model both air and CNT as solid model. This 3-D modeling approach increases the number of elements and nodes and hence decreased the computational capacity in case we have to model large RVE. In the current analysis we have used a thermal link element to represent the CNT and the air as a single material. This will result in 1-D element for CNT and hence reduce tremendously the size of the problem. This approach also gives us flexibility in modeling different aspect ratio and of different orientations.

To model CNT as a line element we have to first evaluate the effective thermal conductivity of CNT with air trapped inside. An analytical way of calculating the effective thermal conductivity is to apply the Fourier's Law on the combined CNT and air and equal it to a corresponding equivalent material.

The approach we followed in this study showed that the ANSYS based FEM calculations for the thermal conductivity of the polymer composites embedded with the CNTs are effective and have been validated using the previous studies based on analytical and/or experimental calculations.

Balancing of Flexible Rotors at Low Speed

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Abstract

Mass unbalance is one of the most common problems encountered in rotating equipment. All rotating machinery have some degree of mass unbalance caused by a variety of reasons, some of which are related to design and manufacturing processes and others are developed during installation and operation. Eventually, balancing of rotors has become a necessary corrective technique that takes place several times during the machines' service life in order to bring the associated vibrations to some acceptable limit. It is well-known that prolonged exposure to the vibration results in damage and increased downtime of the machine. The demand for high-speed light-weight machines has resulted in rotors which deform elastically during their operation. A rotor is normally regarded as flexible, when it operates close to or above its natural frequency. In this case, the problem of unbalance becomes more complicated due to interaction with the elastic deformations of the rotor, and thus calling for a special balancing procedure. eigenvalues and responses from the unbalanced rotor through modal and harmonic responses analyses at low-speed to determine the correction parameters. The rotor modeling and analyses were carried out using ANSYS and MATLAB. The method was tested numerically to validate its applicability and the results obtained were encouraging.

Experimental and Numerical Investigations of Flow-Accelerated Corrosion (FAC) Downstream of Orifices

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Abstract

The main objective of this paper is to evaluate the hydrodynamic parameters that influence the flow-accelerated corrosion (FAC), downstream orifices, under single-phase flow conditions. Numerical and experimental simulations were performed to determine the mass transfer rate of hydrocal (CaSO4.1/2H2O) wall downstream of three different orifices, with orifice to pipe diameter ratios of d/D = 0.25, 0.5 and 0.74, and Reynolds Number, Re = 20,000. Computational Fluid dynamics (CFD) analysis, using Low Reynolds Number (LRN) model, was used to solve the Reynolds averaged flow and species transport equations, in the numerical investigations. Laboratory experiments, using test sections made of hydrocal (CaSO4.½H2O), were carried out to validate the present numerical results. The numerical results were compared with data from the present experiments. The maximum FAC wear rates were found to occur at approximately 1-3 pipe diameters downstream of the orifices. This location was also found to correspond to the location of skin friction coefficient and the elevated turbulent kinetic energy generated within the flow separation vortices downstream of the orifice. The current study offers very useful information for FAC engineers for better preparation of plant inspection scope.

Effect of Drawing Temperature on the Mechanical Properties of PET/CNT Nanocomposite fibers

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Abstract

Poly(ethylene terephthalate) (PET) is a semicrystalline polymer that has a good balance of mechanical properties, dimensional stability, chemical resistance, and cost. Carbon nanotubes (CNT) material is added using a melt spinning process in order to enhance the mechanical properties of PET. Further enhancement of mechanical properties of as extruded fibers can be achieved via drawing process. In this work the influence of drawing temperature on various mechanical properties such as modulus of elasticity, yielding stress and tensile strength has been studied. PET/CNT nanocomposite fibers reinforced with 1 wt% CNT are drawn at 50mm/min and in the temperature range of 16oC to 100oC. These drawn fibers were then tested using a tensile machine and the mechanical properties were analyzed. In this range of drawing temperatures the best mechanical properties were obtained between 50oC to 70oC. At this temperature, the drawn PET/CNT nanocomposite fibers were found to have an increment of about 40% in the young's modulus, 70% in the yield strength, and 32% in the tensile strength, compared to the fibers drawn at room temperature.

Simulation of an inclined solar water distillation (ISWD) system with realistic parameters

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Abstract

In this paper an inclined solar water distillation (ISWD) system is simulated with realistic parameters. The energy and mass balance equations are solved by using Engineering Equation Solver (EES) software. The simulation results are compared with the results reported in the literature and it is found that the present study estimates that the condensation rate is reduced approximately by 8.5%. Although low flow rates of feed water increases the yield, certain minimum flow rate must be maintained to uniformly wet the entire absorber surface. This paper discusses the modified parameters which must be considered to perform the simulation study realistically.

Modeling of Ion Transport Reactor for Oxyfuel Combustion

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Abstract

Abstract This paper aims at investigating the performance of a cylindrical ion transport reactor designed for oxy-fuel combustion. The cylindrical reactor walls are made of dense nonporous mixed-conducting ceramic membranes that only allow oxygen permeation from the outside air into the combustion chamber. The sweep gas (CO2 and CH4) enters the reactor from one side mixes with the oxygen permeate and the products are discharged from the other side. The process of oxygen permeation through the reactor walls is influenced by the flow condition and composition of air at the feed side (inlet air side) and the gas mixture at the permeate side (sweep gas side). The modelling of the flow process is based on the numerical solution of the conservation equations of mass momentum energy and species in the axi-symmetric flow domain. The membrane is modelled as a selective layer in which the oxygen permeation depends on the prevailing temperatures as well as the oxygen partial pressure at both sides of the membrane. The CFD calculations were carried out using FLUENT 12.1 while the mass transfer of oxygen through the membrane is modelled by a set of user defined functions. The model results were validated against previous experimental data and the comparison showed a good agreement. The study focused on the effect of oxygen partial pressure and temperature on the resulting combustion zones inside the reactor for the two cases of co-current and counter-current flow regimes. The results indicated that the oxygen to fuel mass ratio increases as the percentage of CO2 increases in the inflow sweep gas for both co-current and counter-current flows. The obtained sweep mixture ratio (CO2/CH4) of 24 is found within the stoichiometric limit over most of the reactor length in the co-current configuration whereas the sweep mixture ratio of 15.67 is found in the counter-current configuration due to the high O2 permeation.

Combustion Characteristics of Micro-channel Flows

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Abstract

The demand for miniaturized power source is increasing quickly with the fast development of MEMS (micro electro mechanical systems) devices. A key component of these devices is a micro-combustor in which the fuel-air mixture is burnt. In recent years, hydrocarbon-fueled catalytic micro-reactors have been the focus of intense research efforts for a variety of portable power production systems. Applications range from scaled-down thermal engines, wherein a catalytic micro-burner is used for direct chemical-to-thermal energy conversion, to catalytic micro-thrusters for space applications, and to micro-reactors used for fuel reforming in micro solid oxide fuel cells. The present work is aimed at developing Computational Fluid Dynamics approach for the investigation of the combustion characteristics of micro-channel flows. The simulations are based on the numerical solution of the conservation of mass, momentum, energy and species transport equations of two dimensional flows. It was observed that as the inlet flow velocity increases the region of maximum temperature moved downstream. The present work as being related to micro-channels will provide a basis for development of new technologies such as carbon free combustors for use in gas turbines and boilers in order to reduce carbon dioxide emissions.

CFD MODELING OF A 2D ION TRANSPORT MEMBRANE

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Abstract

Ion Transport Membranes (ITMs) offer promising oxygen production technology with high purity. The separation rate of such ITMs can be increased by replacing the conventional inert sweep gas with a reactant/diluent mixture (e.g. CO2, CH4) as this reduces the permeate partial pressure on the permeate side of the membrane, which, along with the temperature, governs the permeation flux. The present work is aimed at modeling of 2D Ion Transport Membrane to investigate the performance of ITM's by varying the mass fraction of sweep gas at constant flow rate. Thus, a computational fluid dynamics approach is developed to predict the species transport characteristics. The oxygen permeation flux increases if the partial pressure of oxygen at feed side is increased. It is also found that the permeation flux decreased with increase in CO2 mass fraction.

Exergetic Performance Analysis of an Air Conditioning System Suitable for Hot and Humid Climates

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Abstract

Cooling and dehumidification are two air conditioning processes suitable for hot and humid climates. This study presents a theoretical analysis based on the second law of thermodynamics to investigate the performance of a proposed air conditioning system. The system consists of a secondary cooling coil (pre-cooler) in addition to the evaporator found in conventional vapour compression air conditioning systems. The secondary coil is aimed to pre-cool the warmed air stream before entering the primary coil (evaporator) by recycling the condensate water in order to achieve energy saving. It is found that 1oC of pre-cooling leads to a significant increase in the second law efficiency and decrease in the exergy destruction within the process.

Evaluate two-phase frictional pressure drop prediction methods

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Abstract

Two phase pressure drop experimental data have been collected for horizontal, inclined, and vertical test sections of (148 μm- 52.5 mm) internal diameter of which the working fluids include (R-134a, R-123, R402A, R502A, R12, R22, R236EA, Propane, Ammonia, Water-Steam, Water-Kerosene, Glycer-Air, Oil-Air) over mass velocities from 12 to 6000 kg.m-2.s-1 and mass quality from 0.0 to 1.0. The data have been used to evaluate the prediction accuracy of leading two-phase pressure drop correlations, and to determine for which flow conditions each correlation can predict better. Along the study, the parametric trend of two-phase pressure drop with varying flow conditions has been documented. The results of assessment have been tabulated and the comparisons between correlations and experimental data have been demonstrated in graphical form. From these results, it has been shown that the correlations vary from each other with error in predicting the pressure drop of greater than 300% in some of the extreme cases. The results of the analysis are consistent with other results published in the literature.

Effect of Post Treatment on the Mechanical Properties of Electrospun Nanofiber Mats using Polyethylene Oxide (PEO)

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Abstract

Electrospinning has been considered for its efficiency for the fabrication of polymer nanofibers. Various polymers have been successfully electrospun into ultrafine fibers in recent years mostly in solvent solution and some in melt form. This study investigates the mechanical properties of as-electrospun and post treated PEO (Poly ethylene oxide) nanofibers via electrospinning. The post treatment temperatures of 40 and 50ºC with two different strain displacement rates (0.05mm/sec and 0.1mm/sec) were used in the present investigation. Slower strain displacement rate of 0.05mm/sec showed improvements in the mechanical properties, Young's modulus E, of over 100% and 83% for the 40ºC and 50ºC treatments respectively were observed and the overall UTS values improved as the temperature was increased. SEM micrographs showed bonding of the fibers as well as the morphology of the as-spun and as-treated fibers. XRD was employed to obtain information on the crystallinity of the nanofibers before and after post treatment.

Characterization of Mechanically Milled and CNTs-Reinforced Al-based Nanocomposites

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Abstract

Powder metallurgy method has been a promising route for the development of composites. In the present work, two types of Al-based alloys composites were reinforced with carbon nanotubes (CNTs) by planetary ball milling. Mechanical milled powders were ball milled at the intervals of 1, 3 and 5 hours to observe dispersion of CNTs during different times and conditions. The effect of CNTs concentration (ranges from 0.5 to 2 wt.%) and milling time on the microstructure of un-sintered composites were determined. The mechanically milled powders were characterized by scanning electron microscope (SEM), EDS, Mapping, X-ray diffraction (XRD) and particle size analyzer. Crystallite sizes as well as the accumulated strains were determined from the XRD data. The results showed dispersion of CNTs into the aluminum powder matrix at different mechanical milling times and range of CNTs concentrations.

A Study on Non-Homogeneous Array on One and Two Degree of Freedom Helmholtz Resonators

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Abstract

In this paper a study on noise attenuation capability of Non-homogeneous array of one and two degree of freedom Helmholtz resonator is done. A closed form equation for the transmission loss for both configurations is derived. The analytical results were compared with the published experimental results and they show a good agreement. The analytical results are verified using COMSOL a FEM based software. The novel concept of non-homogeneous arrays is found to be of various uses in the industries where applications of noise control is a necessity.

Experimental Evaluation of Commercial Available TFCs Reverse Osmosis Desalination Membranes

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Abstract

Reverse osmosis (RO) desalination systems are being increasingly used in the world as an efficient, reliable and cost-effective technology. It is widely used for the production of municipal and in¬dustrial grade water treating seawater and brackish water. RO desalination has been widely and successfully used in Middle Eastern oil-producing countries and even in domestic usage. Polymer materials considered for use in these applications must maintain mechanical properties in the working fluid over their target lifetimes. In potable water, chlorine and pH combine to create an oxidative environment, commonly characterized by the oxidative reduction potential (ORP), that can chemically attack a polymer, resulting in permanent loss of mechanical strength and stiffness. Water absorption and hydrolysis can also impact polymer properties. In the present study, experiments were conducted to evaluate the mechanical performance of some flat sheet membranes of different companies, and polysulfone under both wet and dry conditions. Mechanical performance was evaluated by measuring the change in different mechanical properties like Young's modulus, yield strength, strain at break, fracture strength and graphical representation of resulted data under both wet and dry conditions. Polyamide composite film resulted in 619N/m2 modulus of elasticity, 69.3 N/m2 fracture strength and a total of 37% strain at the break. All samples have shown repeatability in results and polyamide composite was found to have highest values for modulus of elasticity lower strains and higher fracture stresses. All tests were conducted over the same strain rate and at a constant temperature.

Study of Microstructure and Properties of VC addition as Grain Growth Inhibitor and Effect of Initial Particle Size in Ultrafine WC-9Co Cemented Carbides Fabricated by Spark Plasma Sintering

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Abstract

The present work is focused on under-standing the effect of grain growth inhibitor on the microstructure and properties of ultrafine WC-09Co cemented carbides. Characterization was investigated using X-ray diffraction, Focus ion beam, scanning electron microscope and mechanical property tester. Morphology and phase evolution in the milled powder at different stages of milling were studied. Effect of using different initial particle size of WC in the alloy was also studied. The nanocomposite WC-Co powders were prepared through planetary ball milling method. XRD was carried out at different milling timings, to show the effect of powder milling. Three compositions of WC-9Co, each with different particles size were sintered through Spark plasma sintering process. Further three compositions with the same composition and particle sizes, but with the addition of VC were also sintered through Spark plasma sintering. Sintering cycles and pressures were kept constant. Theses samples were analyzed for the crystallite size, sintering behavior, hardness, fracture toughness, wear and nano indentation tests. In addition to SPS, same compositions were also sintered through HIP and tube furnace, and were characterized accordingly, in order to compare different sintering procedures. VC addition, as grain growth inhibitor, was found to refine the WC crystallite size, increases hardness and fracture toughness of the base alloys. After sintering for 10 min at 1200 °C through spark plasma sintering, beside reduction in the average grain size, hardness of ultrafine-grained WC-Co-0.6VC cemented carbide was found to be HV30 1911 and fracture toughness of the same cemented carbide is over 6.4MN•m−3/2.

Thermodynamics Energy and Exergy Analysis of Aborption Refregernation System for Cooling Operation

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Abstract

Development of Multiphase flow prediction Tools for Oil-Water Flow Characterization in Pipes

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Abstract

Study on the Performance of Three-Phase Horizontal Separator

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Abstract

Fabrication of a Multilayered Ceramic Membrane for Water Purification

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Abstract

Design and Manufacturing of an Insert for Drilling Tool Using WC-Co Nanocomposite

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Abstract

Influence of Synthesis Parameter on MFI Zeolite Layer for Reverse Osmosis (RO) Water Desalination Process

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Abstract

Effect of Carbon Nanotube (CNT) Content on the Mechanical Properties of PET/CNT Nanocomposite Extruded Fibers

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Abstract

Production and Quality of Melt Spun Nanocomposite Fibers Made of Polyethylene Terephthalate (PET) and Multiwall Carbon NanoTube (CNT)

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Abstract