King Fahd University of Petroleum & Minerals

Deanship of Graduate Studies

in collaboration with

Deanship of Student Affairs

Sunday, Feb 03 – 04, 2013

GRADUATE RESEARCH DAY 2013

Book of Abstracts

Graduate Research Day 2013 Organizing Committee:

- Basim Abussaud (Chairman)
- Hesham Merdad
- Khalid Alramadhan
- Khondokar Nahiduzzaman
- Marwan Abu-Amara
- Watheq Al-basheer

Introduction

This 7th Graduate Research Day 2013 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 will be inaugurated by H.E. the Rector on Feb. 03, 2013 at 8:15pm in Bldg. 20.

The 7th Graduate Research Day 2013 has the following features:

- Presentations by graduate students of KFUPM as a preparation for the 4th Saudi Student Conference to be held in April 2013. 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 7th 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 Graduate Research Day 2013 Book of Abstracts.

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

Thank you…

Prof. Salam A. Zummo
Dean of Graduate Studies

Summary of Contributions & Departments Coordinators

College	Session	Chair	Numbering format	M	Page #	Department Coordinator	Contributions			
							Submitted	Accepted	% Acce	TotalAcce
Science	**1**	Dr. Watheq Al-Basheer	1Axx	CHEM		Dr. Hassan Al-Muallem				
			1Bxx	PHYS		Dr. Watheq Al-Basheer				
			1Cxx	MATH		Dr. Mohammad Z. Abu-sbeih				
			1Dxx	ES		Dr. Khalid Al-Ramadan				
CCSE	**2**	Dr. Marwan Abu-Amara	2Axx,2Bxx	ICS		Dr. Mahmoud Omar Elish				
			2Cxx, 2Dxx	SE		Dr. Mojahid F. Saeed Osman	20	17		
			2Exx, 2Fxx, 2GXX	COE		Dr. Marwan Hassan Abu-Amara				
CIM	**3**	Dr.Hesham Merdad	3Axx	MBA		Dr. Abdulwahab S. Al-Gahtani	31	26		
				MKT		Dr. Abdulwahab S. Al-Gahtani				
				MGT		Dr. Abdulwahab S. Al-Gahtani				
				MIS		Mr. Mustafa F. Ahmed				
CED	**4**	Dr. Khondokar Nahiduzzaman	4Axx	ARE		Dr. Mohammad A. Hassanain				
			4Bxx	CRP		Dr. Khondokar Nahiduzzaman	3	3		
College of Engineering Sciences and Applied Engineering	**5**	Dr.Basim Abussaud	5Axx,5Bxx, 5Cxx	CHE		Dr. Basim Ahmed Abussaud	26	25		
			5Dxx	CE		Dr. Talat A. Bader				
			5Exx	PETE		Dr. Enamul Hossain				
	6	Dr.Ali Muqaibel	6Axx, 6Bxx 6CXX,6DXX	EE		Dr. Ali Hussein Muqaibel	65	55		
	7	Dr. Samir Nadir Mekid	7Axx,7BXX	ME		Dr. Samir Nadir Mekid				
						TOTAL				

Table of Content

Coverage of N-wise Testing Using Genetic Algorithms

Hassan Al-Khadhem
Department of Information and computer science
King Fahd University of Petroleum and Minerals
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Abstract

Component-based software engineering has been an emerging trend for software development. However, for software that comprises a large number of components, it is infeasible to test each and every possible configuration within the limited allocated testing budget and time. This will pretty much the case in the current trend of developing systems as a composition of Web services. In this paper we propose a GA-based approach to maximize N-wise configuration coverage with minimal number of test configurations. We compare our approach against other similar approaches found in the literature.

Test Automation for Graphical User Interfaces

Mr. Abdulrhman A. Al-Sari (g201102450 @kfupm.edu.sa)
Software Eng. Department, College of Computer Science & Engineering
King Fahd University of Petroleum and Minerals
Dhahran 31261, Saudi Arabia

Abstract

Nowdays, as people's dependence on the softwares increases, there exists a great chance for the software users to be exposed to many failures, which probably induced by users incorrect behaviors. In this situation, testing human interactions with the software is more difficult than testing the machine programs because we are not aware of the human interaction sequences. For example, a user may double clickpayment button twice and he is charged money twice; or a user may intend to press button of delete data before he inserts no data. Since GUI interaction depends on users, we are actually expecting infinite number of different input instances from the various interactions from the user. So, test automation process could help in this situation; so it can facilitate generating and running all those test cases in order to cover as most as we can of the various user interactions. Graphical User Interface (GUI) is the front-end of the software where the user interacts with software through it. This paper presents the classification of GUI test automation techniques, presenting the concepts of the techniques and supporting them with several illustrations. Also, some open source tools for test automation are presented as examples. Finally, I have presented a comparison for each of those test automation classifications and the open source tools, so that a reader can get benefit and distinguish between them.

Test Automation for Graphical User Interfaces

Software Eng. Department, College of Computer Science & Engineering, KFUPM, KSA.
Mr. Abdulrhman A. Al-Sari (g201102450 @kfupm.edu.sa). Dec, 2012

Abstract

Nowdays, as people's dependence on the softwares increases, there exists a great chance for the software users to be exposed to many failures, which probably induced by users incorrect behaviors. In this situation, testing human interactions with the software is more difficult than testing the machine programs because we are not aware of the human interaction sequences. For example, a user may double clickpayment button twice and he is charged money twice; or a user may intend to press button of delete data before he inserts no data. Since GUI interaction depends on users, we are actually expecting infinite number of different input instances from the various interactions from the user. So, test automation process could help in this situation; so it can facilitate generating and running all those test cases in order to cover as most as we can of the various user interactions. Graphical User Interface (GUI) is the front-end of the software where the user interacts with software through it. This paper presents the classification of GUI test automation techniques, presenting the concepts of the techniques and supporting them with several illustrations. Also, some open source tools for test automation are presented as examples. Finally, I have presented a comparison for each of those test automation classifications and the open source tools, so that a reader can get benefit and distinguish between them.

Arabic Data Preparation for Handwritten-to-Text Alignment

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Abstract

Aligned handwritten-to-text data is essential for the development of document analysis systems. Specifically, Arabic aligned handwritten-to-text data is scarce. In this paper, we describe several document preparation and alignment algorithms that culminate in pixel-level alignment of Arabic handwriting of a known text. The algorithms include several levels of ground-truthing, segmentation and alignment processes. The algorithms are implemented and tested on real data and the results are reported and discussed.

Automatic Semantic Annotation of Arabic Web Content related to Food, Nutrition and Health

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Abstract

To have a successful Semantic Web, it is critically required to have sufficient amount of relevant semantic and high-quality Web content. One way to produce such content is through the semantic annotation of the Web data sources. Semantic annotation is the process of adding machine-readable content to the natural language textual content of the Web sources. Annotating Web content in Arabic language have received less attention compared to Latin Languages specially for content related to specific domains such as Food, Nutrition and Health. Considering the huge amount of emerging Web content, semantic annotation of their contents by hand is neither practicable nor scalable. In this paper, we present an automatic annotation of the Arabic Web resources related to Food, Nutrition and Health domains. The proposed method makes use of developed Arabic OWL ontologies related to those domains. It uses linguistic patterns to discover relevant relationships between named entities in the Arabic Web resources. The extracted information is then associated to the corresponding concepts and object properties of the developed ontology to produce the RDF metadata for the corresponding Web resources. Empirical evaluations of the proposed methods show promising precision and recall. As a contribution, the produced RDF triples could be utilized by Semantic Web searching application to retrieve intelligent and relevant answers to end user's requests. This work also contributes to the vision of the Semantic Web in the targeted domains and to the field of Semantic Web research in Arabic Language.

SOA Based Services: Quality Models' Perspective

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Abstract

Service-oriented Architecture (SOA) can be viewed as a collaborative framework for realizing various services through means of rapid and low-cost development. Organizations adapt SOA because of its ability to handle rapid changes within limited or shortened time intervals.

However a major issue here is the quality of the product, the organizations are aiming to realize. A set of quality parameter or assessment measures need to be defined using which, the organizations can gauge or assess the quality of the software being produced using SOA. Various studies exist in the literature which addresses this quality issue by defining quality models or identifying quality assessment attributes which can be used by organizations in assessing the quality.
The survey presented in this paper is aimed at identifying those techniques which have been described in the literature for assessing quality of SOA applications (products).

Testing techniques for Android applications: an Evaluation

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Abstract

A rapid increase in the mobile and cell phone usage has been observed in recent years. With the widespread of mobile usage many mobiles from various makes and running different operating software or software have flooded the market. Most of the activities today like social networking, business transactions etc. are serviced using mobile phones. As a result a plethora of mobile applications exists in the market for different operating systems which provide these services. With these applications being developed so rapidly, an inspection has to be made whether adequate or rather accurate test techniques are being developed to validate these applications. Also the validation has to be based on what factors will assure a quality android application and whether these quality factors are specific to individual android application or they can be used as a checkmark for the entire android operating system framework. Hence this survey is aimed towards determining the testing techniques being discussed in literature today for android applications or the android architectural framework.

Towards the reuse of multi-view UML artifacts

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Abstract

Software is typically modeled from different viewpoints such as structural view, behavioral view and functional view. A number of important issues regarding mapping of entities during multi-view retrieval of UML models is identified in this study. Few existing works can be considered as applying multi-view retrieval approaches. Yet, none of these multi-view works addresses the issues we have raised. We describe a framework for reusing UML artifacts, and discuss how our retrieval approach tackles the identified issues.

Fuzzy Logic Model for the Prediction of Software Maintainability

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Abstract

The relationship between object oriented metrics and software maintainability is complex and non-linear. Therefore, there is considerable research interest in development and application of sophisticated techniques which can be used to build models for predicting software maintainability. Various maintainability prediction models have been introduced in the literature. However, when predicting maintainability not only product quality measurements are surrounded with imprecision and uncertainty, but also the relationships between the external and internal quality attributes suffer from imprecision and uncertainty. The reason behind that, there are at least two important sources of information for building the prediction model: historical data and human experts. Therefore, in this paper an attempt has been made to utilize the capability of fuzzy logic in handling imprecision and uncertainty to come up with an efficient maintainability prediction model. The proposed model is constructed using object-oriented metrics data in Li and Henry's datasets, which were collected from two different object-oriented systems.

Machine Learning Techniques for Predicating Fault Prone Software Classes and Modules: A comparative and Analysis

Hamdi A. Al-Jamimi < aljamimi@kfupm.edu.sa>
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Abstract

The challenge in today's software engineering is to deliver high-quality software system on time to customers. Quality of a software system is relative to the number of defects reported in the final product. A software fault is a defect that causes a software failure in an executable product. Accordingly, early and effective prediction of defect-prone software modules before deployment is very important to measure the likely delivered quality and maintenance effort, especially for large and complex systems. In the software engineering literature, software metrics have been used widely to predict the software faults. This study is focused on evaluating the high-performance fault predictors based on several machine learning techniques including multi-layer pereceptron, radial basis function, probabilistic neural network, support vector machine and logistic regression. We investigate the performance of the different machine learning techniques and compare them against each other in terms of their ability to predict the software faults. For this purpose, five public NASA datasets from the PROMISE repository have been used to make these predictive models repeatable, refutable, and verifiable. According to the results, for all the datasets, probabilistic neural networks generally provide the best prediction performance, in terms of the accuracy rate, against all the remaining machine learning techniques.

Semantic Approaches for Query Analysis and User Modeling to Retrieve Personalized Food and Health 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 precise health and nutrition related information. That is because the retrieved information might not fit to the user's specific needs due to the huge amount of information scattered in the Internet. Thus, semantic query manipulation and personalization techniques will help and guide users in retrieving more relevant health and nutrition information consistent with their needs. In this paper, we present our efforts to develop a framework for semantic query manipulation and personalization of health and nutrition information. We propose a cross-cultural, cross-language, health and nutrition-based user profile ontology that is used as the basis for query enrichment and result personalization. Moreover, we propose query templates that are used for mapping the user's natural language queries into ontology-based queries. In additions, the user profile is used for customizing and filtering the health and food information to be consistent with the user's needs. We have implemented the proposed framework and the empirical evaluations show promising improvements in the relevancy of the retrieved results and of user's satisfaction.

Authorship Attribution of English Texts Using Feature Mining

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Abstract

This paper addresses the identification of the author of unauthorized documents. We investigated the authorship attribution of English texts using several feature types (viz. vocabulary richness, function words and n-grams features). In addition, feature selection techniques are applied to reduce the dimension of the feature vectors. Three classifiers (viz. Euclidian Distance, Artificial Neural Networks, and SMO-Support Vector Machine) are used. Several experiments were conducted to evaluate the effectiveness of the selected features and classification techniques on the selected corpus. The experimental results show that our system can identify authors efficiently. This work is a baseline for our future work on authorship attribution of Arabic texts.

Parallel Processing XML Queries: A Survey Study

Sadam Al-Azani < g201002580@kfupm.edu.sa>, Dhiaa Musleh and Adam Salahadin
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Abstract

Nowadays, multi-core processors are more popular than single-core processor and they have been altered the course of computing. Although non-parallel XML query processing algorithms can work properly on multi-core processors, they cannot take full advantage of multi-core processors. To optimize using multi-core CPUs, efficient parallel algorithms are proposed to evaluate XML query in parallel. This study provides an overview of existing approaches in the field of parallel XML query processing. To the best of our survey, limited work has been reported in the literature in parallel XML query processing and also there is no literature survey available in this domain. To compare the surveyed approaches, we identified some attributes that can be used as criteria to evaluate different parallel XML processing approaches. Each surveyed approach is compared and discussed based on the proposed criteria: parallelization strategy, partitioning approach, type of query, architecture, speedup and efficiency. We aim this criteria will help guiding researchers to develop new approaches.

A Survey on Testing Security of Web based Applications

Mohammed Rehan Riaz< g201106370@kfupm.edu.sa>, Dr. Jameleddine Hassine< jhassine@kfupm.edu.sa>
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Abstract

As the uses of web based applications are increasing day by day, it is necessary that security of web applications should be given high priority. The aim of this survey paper is to understand the vulnerabilities to help us make the web applications more secure for the end user. Web applications these days are more data intensive and hence catching the eye of the malicious user who exploits the vulnerabilities to get hold of critical information present in banking, financial and even in oil and energy firms. According to the Open Web Application Security Project (OWASP) , SQL Injection and Cross Site Scripting Attacks are the top most risks for an attacker to exploit. Hence, we limit the scope of this survey on understanding SQL Injection Attacks and Cross Site Scripting Attacks and recent approaches on how to detect and prevent them thereby enhancing the security of the web applications.

A Survey on Software Process Improvement & its Frameworks

Mohammed Rehan Riaz< g201106370@kfupm.edu.sa>, Dr. Moataz A. Ahmed< moataz@ kfupm.edu.sa>
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Abstract

The quality of a developed product depends on the quality of the process being followed. As dependence on software systems for critical functions is increasing day by day, so is the importance of software quality. Software quality can seriously impact businesses of various organizations irrespective of the industry they belong. Due to this reason organizations started to improve their existing processes for developing software. Such improvisation of the existing processes is known as Software Process Improvement (SPI). This survey paper aims to give the software practitioners a complete idea about SPI and also compares two of the most widely used SPI frameworks (i.e. CMMI and SPICE).

Generalizing Analysis and Design Practices in A Domain: A Framework

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Abstract

The world of constantly changing requirements put a growing demand on the software development companies to adopt rapid software development process to meet time-to-market needs. Reuse is the only strategy that gives the company the ability to ship a new software product with high quality, within a short timeframe, and with sustainable profit. Reuse of early-stage artifacts has been acknowledged to be more beneficial than reuse of later-stage artifacts. Reference models have been considered as good tools to allow reuse across applications within the same domain. However, our literature survey revealed that the problem of automatically developing reference models from existing experience instances has not caught enough researchers' attention yet. Accordingly, in this work we propose a framework for building a reference model that captures the common and variable analysis/design practices, across the different applications in a domain. The framework considers multi-view models in assessing the commonalities and variabilities among given instances. The proposed framework enriches the proposed reference model with learning ability to improve its quality and reusability through its practical reuse.

Class Stability Prediction: A Comparative Study and Analysis

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Abstract

Number of studies have concluded that the largest percentage of development effort is spent on rework and maintenance. This makes the software maintenance a major cost factor and a growing concern. According to the software quality standard ISO 9126, software stability is a key characteristic of software maintainability. Several quality aspects are characterized by using metrics. This paper validates, using statistical analysis, the prediction ability of three different approaches for estimating class stability. The cross validation results showed that estimating the class stability based on a set of class properties is the best compared to the other two approaches that are based on the historical information.

Automatic Context-Sensitive Spell Checker for Non-Native Arabic Speakers using Context Words

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Abstract

Spell checking is the process of finding misspelled words and possibly correcting them. Spell checkers are important tools for document preparation, word processing, searching, and document retrieval. The task of detecting and correcting misspelled words in a text is challenging. Most of modern commercial spellcheckers work on word level and try to detect and correct non-word errors (i.e. sequence of characters that are not a word in the dictionary). However, few of them use techniques to work on real-word errors (spelling errors are words in a text that occur when a user intends to type a word but by mistake he types another correctly spelled word). This is one of the challenging problems in text processing. Moreover, most of the proposed techniques so far are on Latin script languages. However Arabic language has not received much interest, especially for real-word errors.

In this work we addressed the problem of real-word errors made by non-native Arabic speakers using context words. We obtained words' meaning from textual collected corpus which is determined by the context in which the word occurs. A window based technique is used to estimate the statistics of the context words of confusion sets (a group of words that are likely to be confused with one another) collected from non-native Arabic speakers. An automatic spell checking prototype that detects and corrects real-word errors in Arabic text is implemented. The prototype is evaluated and conclusions are presented.

Experimental results showed acceptable correction accuracy. However, it is not possible to compare our results with other published works as there is no benchmarking dataset for real-word errors correction for Arabic text. Hence, researchers use their own datasets.

مرحلة "بعد المعالجة" في نظام التعرف الضوئي الآلي على الكتابة العربية

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بالرغم من تطور التقنيات والطرق المستخدمة في نظام التعرف الضوئي الآلي على الكتابة العربية (OCR) إلا أنه مازال هناك بعض الأخطاء التي تظهر في النص الذي يتم التعرف عليه. وتقتصر الطرق التقليدية في مرحلة بعد المعالجة بتحديد صحة الكلمة من عدمها باستخدام المعجم دون إجراء أي تصحيح للكلمات غير الصحيحة. تستعرض هذه الورقة عدة طرق لمعالجة الأخطاء الناتجة من التعرف الضوئي للأحرف، التي بدورها تساعد في تقليل نسبة الخطأ في نظام التعرف الضوئي الآلي على الكتابة العربية إلى نسبة تفوق 57%.

English to Arabic Assistive Multimedia Tagging based on Speech Recognition

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Abstract

Multimedia data is growing extensively over the internet. Automatic adding captions and subtitles get more importance due to availability of multimedia data in different languages across the world. In this project we proposed natural language and speech processing techniques to add Arabic captions in video. The process consists of multiple steps. In first step we will extract audio from the video and process it for speech to text conversion by using natural language processing techniques. Hidden Markov models techniques are being used for speech recognition. From the extracted speech text we will translate it to Arabic language using largest online available corpus by Google. The translated Arabic text will be added as subtitles/captions to the video automatically.

CUDA – Based Strassen Matrix – Matrix Multiplication

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Abstract

Matrix – Matrix multiplication is one of the most basic operations of linear algebra and scientific computing applications. The standard matrix multiplication algorithm has time complexity of $O(n^3)$ and been extensively investigated. However, an alternative method of Strassen's algorithm is much less investigated specifically on the latest parallel architectures that are GPUs (Graphics Processing Units). The complexity of Strassen's algorithm is $O(n^{2.807})$, which means it will run faster than the standard algorithm for sufficiently large matrices. In this paper, we present its implementation to be run on GPU (Graphics Processing Units) using CUDA programming model and comparing its performance with the conventional implementation of matrix multiplication provided in NVIDIA SDK and highly optimized library functions. The basic strassen implementation gives better performance than the conventional implementations.

MPI Implementation of Parsing for Predicting RNA

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Abstract

Predicting RNA secondary structure is an essential task to determine the relationship between its structure and function. Several approaches have been developed for modeling and analysis of the RNA secondary structure based on diverse methods such as grammars, dynamic programming, matching and evolutionary algorithms. To derive a RNA secondary structure (2-D) from a RNA sequence (1-D), a Stochastic Context Free Grammar (SCFG) for parsing can be used to avoid ambiguous grammars and can generate parse trees efficiently multithreading model by distributing the conflicts among multiple threads. But, multithreading approach doesn't support longer sequences (greater than 20 characters) due to large number of parsing conflicts and huge memory requirements to store intermediate parse trees, parsing actions and states. This paper focuses on the parallel implementation of parsing algorithm for predicting RNA secondary structure using Message Passing Interface (MPI) to be executed on cluster machine for better scalability and performance of determining a valid parse tree with maximum probability.

Using Transformation Languages to reconstruct Use Cases exhibiting Anti-Pattern

Abdullah Owaidh

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Abstract

Anti-patterns in Use case diagrams point out to some parts of the diagram where it may lead to some errors. The detection of anti-pattern has been automated but refactoring the anti-pattern has been left for human inspection. In this paper, an automated correction of use cases exhibiting anti patterns is proposed based on the OMG standard transformational language QVT (Query,View,Translate). We tested our QVT rules on one anti-pattern and the result is very promising. A further implementation of using QVT on various Use Case exhibiting anti patterns will be applied.

Arabic font Recognition using sobel and fractal features

Abdullah Owaidh

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Abstract

Font recognition is considered as the main subject and the basic issues for identification and documents analysis. It is related to many fields in this area such as the character recognition.

Several approaches have been proposed for Arabic font recognition using different methodologies. Other approaches have proposed for Farsi recognition based on different features and method. One of these approaches for farsi font recognition is based on gradient features. In this work, we apply the sobel operator for Arabic font recognition. A new feature based on fractal multi-dimensions are also applied and combine with the gradient features. We have used a dataset that contains 10 fonts with 1500 text images for each font divided such that 1000 text image for each font use for training and 500 text images for testing. Results obtained from the experiment of the project varied as long as we use each feature separately or by combining feature together.

Department of System Engineering

Arabic Phonemes Transcription Using Data Driven Approach by Varying Number of HMM States

Moustafa Elshafei <elshafei@kfupm.edu.sa>, Khalid M.O Nahar,Wasfi G. Al-Khatib, Husni Al-Muhtaseb, Mansour M. Alghamdi
System Engineering Department
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Abstract

Continuous Arabic Speech Recognition, appears in many real life applications. Its speed, accuracy and improvement are highly dependent on the accuracy of the language phonemes set. The main goal of this research is to recognize and transcribe the Arabic phonemes based on a data-driven approach. We built a phoneme recognizer based on a data driven approach using HTK tool. Different numbers of Gaussian mixtures with different numbers of HMM states were used in modeling the Arabic phonemes in order to reach the best configuration. The corpus used consists of about 4000 files, representing 5 recorded hours of modern standard Arabic of TV-News. The maximum phoneme recognition accuracy reached was 56.79%. This result is very encouraging and shows the viability of our approach as compared to using a fixed number of HMM states.

Design of Reliable LQ State-feedback Control

Syed Azher Hussain < g201105450@kfupm.edu.sa>

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Abstract

When dealing with design of fault tolerant for control system, standard linear-quadratic (LQ) design may not be the most suitable because it does not takes into account the failure of complete actuators. In such cases, we prefer Reliable LQ design. Reliable LQ design is a modified version of standard LQ design, it will be shown that reliable LQ design is equivalent to standard LQ design with a slight difference in the performance index. Therefore design procedure includes selection of a proper performance index at which the optimal control has desired reliability. For a reliable LQ regulator, the controls tolerates the insertion of any independent gains (from zero to infinity) into selected feedback loops and thus improve on the known stability gain-margin properties of the standard LQ regulator. Also in these selected feedback loops, a guaranteed performance bound is obtained despite the insertion of gains (from zero to two).

Controller Design for SMIB Installed With STATCOM: A Linear, Robust and Optimal Approach

Syed Azher Hussain < g201105450@kfupm.edu.sa>
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King Fahd University of Petroleum and Minerals
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Abstract

Electrical power system consists of complex network of synchronous generators, transmission lines and loads. These power systems may be subjected to oscillations which might result in power interruption. Damping these oscillations is a very important factor to be considered while designing the power system. There are many ways of damping these oscillations. The widely used electronically controlled FACTS devices can damp these oscillations by dynamically controlling the line reactance which is again achieved by the compensation of series or shunt compensation. STATCOM is a shunt connected FACTS device which has the capability to compensate line reactance and hence damp the oscillations.

The problem discussed in this paper is regarding the utilization of STATCOM, and hence increasing the efficiency of damping the oscillations. The recommended suggestion for this problem is to design a controller, but before doing so the linearized model has to be validated this is done by simulating both the nonlinear and linear model and plotting their states.

Once the linearized model is found to be fit for designing, various controllers are applied to achieve the efficient utilization of STATCOM; we adopt three different ways to design the controller for STATCOM power system. Linear control design includes state feedback controller, robust design technique includes H_2 and H_∞ controllers and optimal control design technique includes LQR and LQG controllers. The ability of each controller in damping the oscillations and increasing the utilization of STATCOM is studied individually in this paper.

Modeling of Quad-Motor Directional Steering

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Abstract

Directional steering system is one of the most preferred drilling systems in the oil and gas industry. In this paper we introduce a new model for directional steering system and the steering principle using four motors in cross configuration, friction is also incorporated in the direction of motion and the overall model exhibits the nonlinear behavior and a non-holonomic system which consist of six states the three Cartesian coordinates (x, y, z) and the Euler angles (ϕ, θ ,ψ) and four inputs which comprises of Drag Torques and Left Forces of the Quad-Motors which are derived by considering the characteristics of the Rock and it's interaction with Drill Bit motor using Specific Energy Principles(Es). This paper describes the development of the Non-linear model of the directional steering system and some simulation results underline the validation of the model.

Modeling, Identification & Control of Evaporator

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Abstract

We are given a four-stage evaporator system which is being identified using various system identification techniques like ARX, ARMAX, BOX-JENKINS, HAMMERSTEIN-WEINER MODEL to obtain models of the given system. The evaporator that is identified is used in milk-powder production as a concentration process before the drying process. The system is basically a MIMO(Multi-Input-Multi-Output) system with three inputs and three outputs respectively. Hence, the various modeling & identification techniques that will be applied would consider the complete system as a MIMO model and study the effects of all the inputs on all outputs and also study the MISO(Multi-Input-Single-Output) case where we see the effect of all inputs on individual outputs separately. Validation of all the modeling techniques is also done using the experimental data to prove that models are good enough for identification and graphs are also plotted to support the validation.

For the control of evaporator system, we use the Sub-Space Identification Method to obtain the state-space model of the given system. The model obtained is basically an eighth order model. Upon obtaining the state-space model, the stability, controllability & observability of the system is studied to ensure that the model is controllable and observable as well. Various Control schemes like Linear Quadratic Regulator (LQR), H-2 controller & H-∞ controller are applied to the model and the effect of each on the eight states of the state-space model is studied. Various graphs are plotted for each of the eight states under each control scheme which revealed improved results.

Distributed Nonlinear MPC Formation Control with Limited Bandwidth

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Abstract

We address leader-follower formation control of autonomous vehicles in a non-ideal communication environment, e.g. underwater channel, where bandwidth is limited and there are communication and computational delays. Moreover, the agents have both input and state constraints on their dynamics. A novel formulation of nonlinear model predictive control (NMPC) is presented, in which agents do not need to estimate neighbor dynamics and collision avoidance is guaranteed. Packet size is reduced considerably by data compression with neural networks. Moreover, this method allows the agents to be sampled at different rates, have different dynamics, constraints and prediction horizons, and be robust to propagation delays. Collision avoidance is achieved by means of a spatial filter based potential field. The sound analytical results are verified by simulations.

Model-based Predictive Control of Reverse Osmosis Desalination System

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Abstract

Desalination by reverse osmosis is a very popular technique used for producing fresh and clean water from salt or brackish water. Reverse osmosis is based upon membrane separation technique and is becoming a major source that provides potable water for the human survival around the world and especially in Arab countries which are located in the driest part of the world. Desalination by reverse osmosis is in demand also because of the shortage of available water resources, the increasing demand of fresh water for drinking, agricultural or industrial purposes, the increasing population etc calls for an urgent need to increase the number of water resources in Arab countries in particular and developing countries in general.

Model predictive control (MPC) is a process control technology that is hugely popular and is being increasingly used in process industries. In this research paper, we present the model based predictive control of a fourth order reverse osmosis desalination system represented in the form of state-space model. It is basically a Multi-Input-Multi-Output (MIMO) system with two inputs and two outputs respectively. We implement the MPC under four cases: without the constraints on input and output, with constraints, changing the weights on inputs & outputs and studying the response and lastly we investigate the MPC for Model Mismatch, with the given data as Actual Model and model with different parameters as the Mismatched Model. The obtained results are illustrated by plotting the inputs and outputs for the four cases and are also discussed.

Optimum Target Levels for a Network of Processes

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Abstract

These days, it is common to have the same item produced with varying features and levels of quality resulting in different products. We consider such manufacturing systems and determine their optimum machine settings. Each process in the system generates a random quality characteristic that has specification limits. Depending on the value of the quality characteristic, a product can be reworked, scrapped or forwarded to the next process. The processes are continuously running, hence we develop the "long-term" probabilities of meeting the specifications. These are used to construct the profit function. We consider the case of a network of processes where each product passes through varying and possibly unique routes with different feeding and exit points. We present a novel technique to readily analyze such systems and develop the objective function to be optimized.

Constrained Kalman Filter as Validity for Multi-Model Identification and Fault Diagnosis of Complex Systems

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Abstract

Multi-model technique for systems identification is an effective approach for representing a complex, uncertain and nonlinear systems by combining several models each contributing to the multi-model output to a certain degree of validity. Validity computation, as one of the procedure in multi-model technique, is crucial to the correct identification of the underlying system. Furthermore it is a key decision making in fault detection and isolation. In this study constrained Kalman filter is proposed for the computation of validity for Multi-model identification of nonlinear systems. It is based on minimizing the global learning objective of multi-model output. Simulation examples for systems identification and fault detection illustrate the effectiveness of the proposed validity computation compared to other commonly used ones.

Neural Network Adaptive Control of Unmanned Vehicle with Slung Loads

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Abstract

Load transportation using Unmanned Aerial Vehicles (UAV) is very beneficial but not much of research is done in this area. The main challenge in this is the model for the vehicle and load system together has not been developed. The UAV being an under-actuated system poses another challenge in the designing of the controller. Then the other main concern is control of the load swing during transportation. All these make it a very interesting topic to be researched and developed. This works aims to present a model for the UAV with a load and then also presents a controller which helps in trajectory tracking of the UAV and another time-delayed feedback controller to stabilize the load swing angles, which work together making the overall system stable.

Integration of Taguchi's loss function in the determination of Optimal production run length for products sold with warranty in a deteriorating production system with a time varying defective rate under allowable shortages

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Abstract:

The paper studies the optimal production run length for a deteriorating production system with allowable shortages for products sold with a free minimal repair warranty period with Taguchi's loss incorporated. The optimal warranty cost is determined by a balance between the warranty cost of the manufacturer and warranty cost of the buyer during its warranty period. The quality of the item is very much linked to its warranty period. A product manufactured with high quality has low or almost negligible post sale services and can be sold with extended warranty period (w) and for high cost. Such types of products are revenue generator for a company. In this competitive world, where quality is considered as one of the major factor in the buyers decision making process, cannot be neglected. This model incorporates the Taguchi loss function to determine the loss in quality. The Taguchi Loss Function is important for a number of reasons. Primarily, to help engineers better understand the importance of designing for variation. The important point here is the fact that quality is related to monetary loss and not to any other factors or conditions. It is more important when a product has a free minimal repair warranty. A product of low quality bring bad name to its manufacture and their is a fear of losing the customers in the long run. The objective of this paper is to minimize the total cost per item by determining the optimal production run length and the time length when backorder is to be replenished with the integration of Taguchi's loss function in the total cost equation. It shows that there exists a unique optimal production run length to minimize the expected total relevant cost function. Numerical examples from the practical area like the tyre manufacturing industry is provided, which sells its products in the market with a warranty period. The features of the model and sensitivity analyses are performed to extract some interesting management insights. Finally, concluding remarks are made.

Self-Tuning Regulator Adaptive Control of an Autonomous Bicycle

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Abstract

In this paper, an adaptive Self-Tuning Regulator to control an autonomous bicycle is proposed. The model used for describing the dynamics of the bicycle is WHIPPLEs BICYCLE MODEL. The roll (lean) and the steer angle of the bicycle are the two outputs of the model and the torques across the roll and steer angle is proposed as the two control variables. The IDENTIFICATION technique used in Self-Tuning Regulator is RECURSIVE LEAST SQUARES TECHNIQUE and the proposed CONTROLLER is STATE-FEEDBACK CONTROLLER with the controller gain calculated using LINEAR QUADRATIC REGULATOR. The autonomous bicycle was tested for varying velocities and it was observed that the adaptive controller gives a good control action of the bicycle model not just within the stable velocity region but outside it as well.

NONHOLONOMIC MOBIL ROBOTS LEADER-FOLLOWER GROUP FORMATION AND NAVIGATION CONTROL FOR KNOWN AND UNKNOWN ROBOT DYNAMICS

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Abstract

The problem of fleet formation under leader-follower strategy for known and unknown robot dynamics and the whole fleet navigation has been addressed using simultaneous localization and mapping (SLAM) navigation unit and artificial potential field formation approach.

In the case when all robot dynamics are known is considered the formation control is developed such that the potential fields control inputs for the followers to control their desired positions around their leader. In this case the nonlinearities of the nonholonomic robot is canceled using feedback linearization. The formation stability of each follower is analyzed using the Lyapunov method and its derivation is provided. The formation control also designed on the assumption that all system dynamics are unknown. In this case on-line NN weight tuning algorithms used to estimate the robot dynamics to guarantee tracking a desired following path. The followers will track its desired trajectory which is generated based on the potential fields. This system will be able to handle cooperative tasks like exploring unknown environments, delivering goods and so on.

An Experimental Study and Parameter Modeling Of Radio Frequency Energy Harvesting

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Abstract

This report investigates the important parameters in Wireless Sensor Networks, powered by some RF source. Experimental data is analyzed for the development of mathematical models of the *charging time, T_c,* and *received signal strength indicator, RSSI.* The models so obtained, explain the spatial variations of T_c and *RSSI* in three-dimensional space with respect to a power transmitter installed in a known position. These parameters are important in deciding the geometry of sensor network to be deployed. Furthermore, the development of routing protocols for wireless-powered wireless sensor networks is also improved with the knowledge of such models. The data acquired at various coordinates of the harvester relative to a fixed position of RF energy source is processed to compute these two parameters. The data is acquired in indoor and outdoor scenarios using commercially available PowerCast™ energy harvester and evaluation board. In addition to the parameter modeling, the feasibility of harvesting the energy from the ambient RF power to energize wireless sensor nodes is also assessed for PowerCast™ hardware. Findings of this report can be a useful reference for researchers working in this area.

Design of Model Predictive Controller for A Constrained Non-Minimum Phase Four-Tank Process

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Abstract

This paper considers a multivariable process for a controlled prototypical four tank system and its stability and error tracking is analyzed. The four-tank process is ideal for illustrating many concepts in multivariable control. The multivariable four-tank system exhibits complex dynamics, which includes interaction, transmission zero, and non-minimum phase characteristics that emerge from a simple cascade of tanks. The linearized dynamics of the system have a multivariable zero that is possible to move along the real axis by changing a valve. The zero can be placed in both the left and the right half-plane. Design of a discrete time Model Predictive Control is discussed based on this model. In this paper, a linearized state-space model of the four tank process was developed in the non-minimum phase region and a model predictive controller was designed based on constrained on input and output, using this model. The main objective of this designed controller is to control the level in the lower two tanks with two pumps v_1 and v_2 respectively. The performance of this set up was studied for reference tracking.

Statistical Analysis of Arabic Phonemes for Continuous Arabic Speech Recognition

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Abstract

Although Arabic is the world's second most spoken language in terms of the number of speakers, Arabic automatic speech recognition (AASR) did not receive the desired attention from the research community. In this paper, we introduce thorough statistical analysis of the Arabic phonemes from a widely used Arabic corpus that was developed by King Fahd University of Petroleum and Minerals (KFUPM) with support of King Abed Al-Aziz City for Science and Technology (KACST). We study various parameters, such as the number of frames a phoneme occupies, the phonemes frequency, the mean length in frames, the standard deviation, the mode, and the median of the phoneme boundary. In addition, other language-model related information such as the bigram information is also studied. The results show that phonemes can be clustered into groups and that based on various statistical information, one can design the most suitable HMM for each phoneme in terms of the number of states and other model parameters.

Computer Engineering

Evaluation of Kinect 3D Sensors for Outdoor Monitoring of Construction Sites

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Abstract

In the recent years, researchers have been attempting to hack the low-cost three dimensional color and depth sensor from Microsoft named 'Kinect' various applications of computer vision, smart homes, tele-health, and surveillance systems. These include simple detection of humans, objects, simultaneous localization and mapping (SLAM), monitoring construction sites, departmental stores, etc. However, most of the research has utilized the Kinect for indoor purposes only, due to its infrared-based depth sensing which gets adversely affected in sunlight. In this work, we perform practical experiments and evaluate the performance of the Kinect's 3D sensors under varying outdoor conditions (with varying sunlight, varying times of the day, etc.). The results obtained so far have shown that Kinect's performance is encouragingly good in controlled outdoor environments (where sunlight is not directly hitting the areas). However, the Kinect's performance degrades in open-air outdoor scenarios. Our work can significantly help in further research into using Kinect for lighting invariant robust outdoor applications.

Review of Silhouette based Gait Recognition Techniques for Biometric Authentication Systems

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Abstract

Researchers have shown that the behavioral walking characteristics of people, known as gaits, are an effective means to identify them. Over the years, numerous techniques have been proposed to utilize gait as a biometric in authentication systems. The basic steps involved in a gait recognition system are: (1) Gait Feature Extraction, (2) Feature Representation, (3) Training and Classification. As for the gait features extraction techniques, these revolve around finding the best ways to uniquely represent individuals by extracting the best combination of gait features which are optimal in terms of dimensionality, size, memory, and complexity to obtain them from video sequences, while ensuring that the recognition rates are not negatively affected. Research is also going on developing ways to effectively reduce the dimensionalities of these feature vectors and represent them in a fashion that can be easily fed to intelligent classifiers. In this end, researchers are also trying to come up with better training and classification engines like SVMs, ANNs, etc. This work summarizes the significant works in each of the three phases of gait recognition systems in the context of silhouette based gait recognition.

Satellite Monitoring of Wireless Sensor Networks (WSNs)

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Abstract

Wireless Sensor Networks (WSNs) are one of the most important technologies of this century. There are several challenges since WSNs are usually deployed in remote and hazardous areas. One of them is how to transmit the data from all the sensor nodes efficiently to a server/database for back office application to process the information. The purpose of this project was to find a way to transmit the sensor data from WSN effectively in real time to a back office application. I proposed and implemented a global, low power satellite monitoring solution for remote monitoring of WSNs. The project implements an end-to-end solution from the WSN installed in the field and to a user via an internet enabled device. The project was divided into 3 semi-independent tasks: Interface with WSN and programming of the satellite terminal; XML gateway interface to receive/send/decode messages from the service provider (Honeywell's message handling system) and to store the data in the database; and an interactive web application (http://www.ccse.kfupm.edu.sa/~gr199305420/sat/). The web application provide Fleet report (arranged by region) and message history report for each asset/unit. It also support interactive Google maps (via JavaScript based API), Google Earth (kml files) interface, for enhanced 3-D visualization of information, charts/graphs of sensor data and Excel sheet download for detailed analysis of data. The web application utilizes DHTML, PHP, JavaScript, jQuery and CSS for dynamic content of the web interface.

Prospective Features of 5G Mobile Communication Networks

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Abstract

Over the past few decades cellular services have gained phenomenal evolution and progress in every aspect such as subscribers, data rates, services, etc. Observing the current trends in coming up with better techniques to efficiently utilize resources mainly covering the frequency spectrum and optimizing the shared network resources 5G is considered to be the next benchmark in wireless broadband services. 5G is anticipated to be a unifying technology accommodating large number of subscribers and maintaining quality of service. Currently specifications for 4G LTE Advanced have been finalized and several studies on prospective features available in upcoming 5G technology are under debate and discussion. This report provides a comprehensive survey for on prospective modifications in the current architecture and potential updated attractive features expected in 5G technology. Conclusively a pin pointed difference between 4G LTE Advanced and 5G is stated based on the knowledge gathered from available literature and relevant discussions.

Real Time Publisher Subscriber Middleware Over Bluetooth

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Abstract

Because of its reliability, Flexibility, High performance, Data-centric, and rich QoS; Data Distribution Service (DDs) middleware became one of the best solutions in high performance and real time network. Unlike other middleware's that depend on client server communication scheme, DDS which recently standardized by Object Management Group (OMG) based on real time publisher subscriber communication provides high performance and real time response. On the other hand, Bluetooth which is an important wireless communication with versatile and flexible wireless network; it can be used in vast discipline because it operates in license free frequency with low power consumption. In this paper, we will evaluate DDS middleware performance by measuring latency, throughput and jitter for the transmitted packets between two computer devices over Bluetooth network. Furthermore, different QoS have been used in the experiment with different value.

Inventory Management using a mix of Active and Passive RFID tags with a Mobile Reader

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Abstract

Due to the recent technological advancements, RFID technology has become cheaper and is used in many applications such as inventory tracking application. In 2004, RFID was identified as one of the ‘‘Ten Technologies to Watch’’ by CNN. It is one of the many Automatic Identification (Auto ID) technologies. This type of technology is used to identify a particular object, collect data from that object and then feed that data into a computer system without the need of human involvement. RFID has emerged as a strong emerging technology and its cost has considerably reduced due to recent advancement in science. The numerous benefits of its application to Inventory Management have motivated us to use it. In this paper, we design, simulate and analyze an inventory management system for a warehouse. We use a single mobile reader and a combination of active and passive RFID tags. Passive tags are used due to its very low cost compared to that of active tags. A querying resolution algorithm is proposed which makes use of the mesh network formed by active tags when it is available and uses the mobile reader otherwise. We vary the percentage of active tags in the network and calculate the energy consumption, network lifetime, query resolution and distance travelled by the mobile reader. We use the results to find the right percentage of active tags in the network which will give good performance at low cost.

UCloud: A Simulated Hybrid Cloud for A University Environment

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Abstract

Universities all around the world play a vital role in improving the society. But in the current economic crisis, they are facing difficulties in providing necessary resources for research and educational purposes. The solution of this problem is in the used of Cloud Computing. It is a new distributive computing model which provides applications and services over the internet. In this paper, we investigate, study, and design a cloud for a university environment. We propose architecture based on the hybrid cloud model which uses both the public and private cloud. It consists of two main parts, i.e., Cloud Management System and the hybrid cloud. The architecture is simulated using CloudSim. CloudSim is a toolkit (library) for simulation of Cloud computing scenarios. The evaluation of the architecture is done in two separate scenarios. In the first one the number of tasks is kept constant and in the second, the number of tasks is varied. The results obtained are encouraging and support the use of a hybrid cloud solution for a university. The public cloud is used only to get better performance or when the load is too high for the private cloud. The results show that high performance can be obtained while keeping the cost low.

Quality of Service Provisioning in Bio-Sensor Networks

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Abstract

Bio-sensor networks are used for monitoring and controlling biological processes taking place inside humans and animals. They respond to any biological phenomenon occurring within the body of the subject. Bio-sensors generate heat during transmission and recharging which affects the tissues of the subject where they are implanted. Hence, to avoid any tissue damage, biosensors require careful control of their operating temperature to avoid any harm to the subject. In this paper, we propose an optimal policy that takes into account the safe temperature and power zone of the bio-sensor as well as the traffic input and maximizes the system throughput by minimizing the loss rate and average power. The system is described as a Markov Decision Process and the average cost criterion is chosen to obtain the optimal policy. The results obtained indicate a monotonic increase in samples transmitted as the channel states improves for independent channels. For the case of correlated channel states, the transmission rate is found to be non-increasing as channel gain increases.

Parallel Lossless Compression Using GPGPU's

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Abstract

Most of the current lossless data compression algorithms are serial in nature and therefore cannot exploit the massively vector processing inherent in GPGPUs. In this regard recent research has been going on in parallelizing bzip2 lossless data compression algorithm which in term requires the parallelization of burrows wheeler transform. In this paper we present a data parallel algorithm for implementing BWT which can help in implementing lossless data compression on GPUS. Performance of parallel algorithm is conducted using NVIDIA's CUDA enabled GeForce 540M GPU.

Analysis of Computation-Communication Cost Tradeoff in Wireless Multimedia Sensor Networks (WMSNs)

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Abstract

Wireless multimedia sensor networks (WMSN) have gained significant attention in past few years. These networks have low powered devices that are used for multimedia communication. In WMSN, energy is an important aspect because multimedia applications require large amount of computation and communication energy. Different compression techniques are used to save the computation-communication energy. In this paper, H.264, DiscoverDVC and DISPAC are used for analysis. A theoretical model is developed to calculate computation energy for a given compression algorithm then simulation is used to determine communication energy required by the algorithm. Some algorithms are computation efficient others are communication efficient. But it really depends upon the situation in which these algorithms are used.

Prototype Implementation of Recursive Time Synchronization Protocol (RTSP)

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Abstract

In any distributed system, time synchronization plays an important role. Distributed wireless sensor networks (WSN) often require accurate time synchronization for coordination and data reliability. But precision of time synchronization is limited to scope and criticality of the application. Energy, lifetime and time synchronization are important parameters of any wireless sensor network. Recursive time synchronization protocol (RTSP) can achieve these parameters effectively and efficiently. RTSP elects a reference node for time synchronization in entire network. Reference time is adjusted at intermediate node to compensate for propagation and processing delay. In this paper, a prototype of RTSP is implemented to investigate its accuracy and efficiency in the real time environment. Arduino Uno is used as microcontroller for logical design development and Xbee for communication. In prototype implementation, a relay network is created using mesh topology for testing and experimentation of RTSP. Prototype shows promising results for future RTSP implementation in a larger network.

Implementation of Bittorrent Protocol over Real Time Data Distribution Service

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Abstract

In the last view years, Bittorrent protocol got a lot of adoption on peer to peer file sharing systems, and still as the dominant traffic generation on the internet, this protocol suffers from the dependency of a single server called a tracker for the coordination and content routing between its peers which is a single point of failure problem. Using multiple trackers or DHT (distributed hash table) were attempts to solve this problem. In this paper we try to distribute the tracker service between the peers using RTI-DDS middleware. This middleware has a built in simple discovery service and rich configurable QoS policies that control the behavior of communicating peers inside the domain of this middleware. We design a new architecture to move Bittorrent protocol to work on top of RTI-DDS middleware and build a prototype according to this design.

Investigating Security Vulnerabilities for Economic Denial of Sustainability (EDoS) Attack in Cloud Computing

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Abstract

Cloud computing is a new paradigm of computing that provides scalable IT resources as a service over the Internet. However, as more and more information is placed in the cloud, concerns about the security of the cloud have increased. And hence, these concerns have hindered the migration of many organizations to the cloud technology. Economic Denial of Sustainability (EDoS) attack is considered one of the security concerns in the cloud computing systems. In this paper, we investigate the vulnerabilities of the cloud computing that may cause EDoS attack. Likewise, we explore the countermeasures for each vulnerability. Then we classify these vulnerabilities into vulnerabilities inherited from cloud features and vulnerabilities inherited from general security issues.

Implementation of a Hybrid Cloud for a University

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Abstract

Utilizing the available infrastructure and reducing the cost of operation are major concerns for the IT departments nowadays. Cloud computing has a many features such as virtualization and elasticity that help better utilize the available hardware and reduce the cost of operation. Many companies, organizations, and universities are moving toward cloud computing technology. In this work, we propose a design of a hybrid cloud for a university, as well as a deployment of some of its services. The university will benefit from the hybrid cloud by moving to the public cloud some services such as web and email services. It will also move to a private cloud some local services such as registration and library services. In addition, the private cloud may offer some other services such as powerful virtual machines, deployable virtual applications, and shared license software.

Design and Deployment of a Cloud Computing Platform for Testing Attacks

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Abstract

Cloud computing is a promising technology for the future of IT industry. Many organizations and companies are moving toward this technology. Cloud computing is a suitable solution for organizations and academic universities which are looking for saving money in IT and improving performance and availability. In our work, we propose a framework for a cloud computing platform for testing attacks that has been designed to be used in an academic lab for research purposes. This framework will be used to address some security issues related to the cloud computing platforms. This framework will be suitable for carrying out attacks using penetration tests, as well as ways to measure the impact of attacks on the cloud.

Binary Particle Swarm Optimization (BPSO) Based State Assignment for Area Minimization of Sequential Circuits

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Abstract

State assignment (SA) for Finite State Machines (FSM) is one of the main optimization problems in the synthesis of sequential circuits. It determines the complexity of its combinational circuit and thus area, delay, testability and power dissipation of its implementation. Particle swarm optimization (PSO) is a non-deterministic heuristic that optimizes a problem by iteratively trying to improve a candidate solution with regard to a given measure of quality. PSO optimizes a problem by having a population of candidate solutions called particles, and moving them around in the search-space according to simple mathematical formulae. In this paper, we propose an improved binary particle swarm optimization (BPSO) algorithm and demonstrate its effectiveness in solving the state assignment problem in sequential circuit synthesis targeting area optimization. It will be evident that the proposed BPSO algorithm overcomes the drawbacks of the original BPSO algorithm. Experimental results demonstrate the effectiveness of the proposed BPSO algorithm in comparison to other BPSO variants reported in the literature and in comparison to Genetic Algorithm (GA) and deterministic algorithms like Jedi and Nova.

A Generalized Modular Redundancy Scheme for Enhancing Fault Tolerance of Combinational Circuits

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Abstract

Nano-scale devices are continuously shrinking, operating at lower voltages and higher frequencies. This makes them more susceptible to environmental perturbations, and distinguished by their high dynamic fault rates. Redundancy techniques are widely used to increase the reliability of combinational logic circuits. In this work, soft error reliability is improved by using such techniques, and based on probability of occurrence for states at the outputs of circuits. A generalized modular redundancy scheme to enhance the reliability of combinational circuits is proposed. Additionally, several aspects regarding the application of this scheme are explored. This comprises types of redundant modules, complexity of correction logic and single versus multiple outputs protection. Also, a methodology for applying the generalized modular redundancy scheme is developed. Reliability analysis for various benchmarks from the LGSynth91 suite shows that the proposed methodology can achieve reliability figures higher than that of triple modular redundancy. In general, significant overhead savings are accomplished in addition to that superior reliability.

Secure Cloud Custom Computing Machines (SC3M) Using FPGAs

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Abstract

Many researchers in different fields of science and engineering are faced with complex problems that require significant computing powers (e.g. DNA/protein sequencing, Metrology, etc.). Traditional, server-based computing clusters are too expensive, difficult to maintain and requires significant efforts from the researchers to parallelize their codes and run it on the cluster. Also, processor systems are designed to be general leading to large inefficiencies of resource usage. In addition, the execution units of a processor aren't optimized to the specific problem being undertaken, which again leads to huge overheads. This research aims at illustrating the practicality of cloud custom computing with FPGAs. It is intended to provide researchers with no hardware design experience with a platform to efficiently implement their algorithms on FPGA-BASED custom computing machines (CCMs) and then be able to run as many experiments on these machines as they need over the internet. So the cloud in this case would be a collection of different CCMs for different clients running on the same FPGA fabric. The CCMs are realized by automatically configuring the FPGAs to implement a hardware-mapped C program. The C program is directly compiled to microinstructions which are then translated to a Verilog description of the data path and control ROM. Three main approaches to performance enhancement are pursued; instruction-level parallelism (ILP), simultaneous thread-level parallelism (TLP), and pipelining (conventional multithreading MT).

Resource Management for OFDMA Systems Using Ant Colony-based Optimization Technique

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Abstract

The problem of sub-channel and power allocation for a multiuser Orthogonal Frequency Division Multiplexing (OFDM) system of maximizing the total system throughput while satisfying the typical constraints of total power and fairness can be modeled as a mixed binary integer programming problem. The optimal solution for this problem is generally hard to find. The typical approach is to utilize a sub-optimal sub-channel allocation algorithm and then obtain the optimal power distribution for that specific sub-channel allocation. In the literature, there exist several algorithms that attempt to solve this problem while making some assumptions to reduce the complexity of the problem. Some of these assumptions include shared sub-channel allocations which transforms the problem into a conventional nonlinear optimization problem. Another is the assumption of uniform power allocation cross all the sub-channels which reduces the problem to a sub-channel allocation problem. In our paper, we used artificial intelligence algorithms such as ant colony algorithm and particle swarm optimization with integer variables to find solution for a multiuser Orthogonal Frequency Division Multiple Access (OFDMA) system which satisfied certain level of fairness between users.

Efficient Computation of Distribution Function for Sum of Lognormal Random Variables Using Legendre Quadrature

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Abstract

The problem of characterizing the distribution of the sum of lognormal random variables (RVs) appears in many scientific fields such as in electronics, biology, economy, engineering and wireless communications. This work proposes simple quadrature-based approximations of the characteristic function (CF) and the cumulative distribution function (CDF) of the sum of lognormal RVs. Recent advances in this field exploit the Hermite-Gauss quadrature (HGQ) approximations to evaluate the CF of a single lognormal RV in terms of quadrature nodes and weights. For the sake of higher accuracy, this paper utilizes the Legendre Gauss quadrature (LGQ) in approximating the CF of a single lognormal RV, and then compares it with HGQ results. This allows more accurate computations of the CDF for sum of lognormal RVs using the LGQ relative to earlier HGQ-based method.

A Hybrid SW/HW Approach for Architectural Modeling and Simulation of Many Core CMPs

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Abstract

Simulation is the most de facto tool for computer architectural space exploration prior to the manufacturing process. Although developing a simulator for a certain class of processing systems may not be an easy job, it is much cheaper and easier than manufacturing this system. In the many-core era, computer architectures became more complex due to having many cores which need to cooperate and communicate through complex interconnection networks and cache coherence protocols. To make things even more complex, the size of the benchmarks is also increasing. These recent architectures and benchmarks suits increased the demand on having more accurate, more efficient, easier to develop and easier to configure simulators in order to take the architectural decisions correctly and quickly. The existing architectural simulators can be classified into three categories (1) Software-based simulators which have been developed in pure software. This kind of simulators is flexible and easy to develop but it is slow because every target cycle is simulated in many host cycles, may be thousands. (2) FPGA-based simulators in which the target architecture is modeled on Field Programmable Gate arrays (FPGAs). These simulators are hard to implement and less flexible than the previous category but they are much more efficient due to the exploitation of fine-grained and coarse-grained parallelism of the FPGAs. (3) Hybrid Hardware/Software simulators where some parts of the simulator are implemented in software and some parts are implemented in hardware. In this paper, we are proposing a trace-driven simulation framework for Chip Multiprocessors (CMPs) in which a fixed trace is generated for every benchmark by a front-end software. Then this trace is fed to a timing model running on the FPGA. Our simulator is a cycle accurate as well as configurable at runtime to facilitate the exploration process by eliminating the need for re-synthesis per each design alternative.

Lamarckian Genetic Algorithm for Automatic Hardware/Software Partitioning for Heterogeneous Computing Clusters

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Abstract

Digital design may either be done through custom digital circuit design that performs a specific function or by coding the function for executing specific instructions on an existing processor. The first approach is called the hardware implementation because a hardware circuit is developed while the latter is also referred to as software implementation because the function is written as a piece of software that runs on a processor. The software approach provided for added flexibility and is conveniently developed on existing hardware whereas the hardware approach is faster and more energy-efficient. Therefore, within the same application there are some components that are suitable for hardware implementation and some components that are suitable for software implementation. Hardware/software co-design and heterogeneous processors provide such hybrid solutions. For such hybrid solutions, a mechanism for partitioning the application components into hardware and software is necessary for optimizing the overall performance. Such a problem is NP-hard in nature, and therefore the use of intelligent techniques is one such way of tackling it. In this paper, we propose a Lamarckian Genetic Algorithm (LGA) for efficient partitioning of circuit components into hardware and software, for implementing a hybrid solution to digital system design.

Handwritten Digit Recognition through MLP-based Neural Networks

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Abstract

Recognizing human handwriting digits has remained a field of research for the past few decades. Such recognition holds promise in several diverse application domains such as; online handwriting recognition on computer tablets; recognition of zip codes on postal mail for sorting; for verifying user signatures on bank checks to thwart fraud attempts. Handwriting recognition is faced with several challenges. The most significant one being the varying dimensions of the handwritten image that needs to be processed and/or normalized to fall within the boundaries of the recognition system requirements. Moreover, handwritings pose varying thickness and position with respect to the margins of the handwriting sample. The format and appearance of the handwritten digits have a major impact on the identification and/or classification, and different subjects have very different writing styles, with digits written by the same person on different occasions also posing a variation. As part of this research work, we investigated various schemes for handwritten digit recognition. By surveying resent research papers that are related to this field, different existing methods based on: preprocessing image data sets, extracting features from them, and their subsequent classification are presented. Second, we propose a classification technique based on the Multilayer Perceptron (MLP) for identifying binary digits '0' and '1' in handwritten documents. The technique maps sets of input data onto a set of appropriate outputs through the backward propagation technique of the MLP classifier. The performance of our implemented algorithm is evaluated based on the well-known "Pen-Based Recognition of Handwritten Digits" dataset comprising of 250 handwriting samples from 44 writers. We also analyze our obtained results and provide discussion.

Bittorrent Implementation using Real-Time Data Distribution Protocol

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Abstract

BitTorrent(BT) in recent years has present as the defector protocol for sharing content over P2P networks. However, Bittorrent should support some level of data transformation with guaranteed Quality of Service (QoS) in heterogeneous Internet environments. We analyze, in this paper, Bittorrent specification and how to improve the performance of bittorrent using RTI's Data Distribution Service (DDS), based on Publish/Subscribe model.

DDS Discovery Protocol Scalability and Performance

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Abstract

RTI Data Distribution Service is an integration platform for real-time systems. The DDS build-in Discovery protocol that allows a Publisher to dynamically discover the matched Subscribers and vice-versa, has a significant effect on DDS scalability and performance. A Bloom filter is an effective, space-efficient data structure for concisely representing a set, and supporting approximate membership queries. Using a Bloom filter in discovery process can help reducing the memory requisites and network traffic. In the other hand, the probability of false positives in Endpoint matching process when deploying the standard static Bloom filter to the DDS Simple Discovery Protocol introduces a problem of bandwidth wastage. In addition, the execution time can be variable which is not suitable for some real-time systems. In this paper, we propose a solution for improving the DDS Bloom Filter based Discovery Protocol by using a dynamic Bloom filter to minimize the probability of false positives occurrence that would lead to overall bandwidth wastage especially when the number of publishers and subscribers Endpoints are huge.

CUDA – Based Strassen Matrix – Matrix Multiplication

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Abstract

Matrix – Matrix multiplication is one of the most basic operations of linear algebra and scientific computing applications. The standard matrix multiplication algorithm has time complexity of $O(n^3)$ and been extensively investigated. However, an alternative method of Strassen's algorithm is much less investigated specifically on the latest parallel architectures that are GPUs (Graphics Processing Units). The complexity of Strassen's algorithm is $O(n^{2.807})$, which means it will run faster than the standard algorithm for sufficiently large matrices. In this paper, we present its implementation to be run on GPU (Graphics Processing Units) using CUDA programming model and comparing its performance with the conventional implementation of matrix multiplication provided in NVIDIA SDK and highly optimized library functions. The basic strassen implementation gives better performance than the conventional implementations.

Symmetry Analysis of the Wave Equation on a Non-static Spacetime

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Abstract

Spherical symmetry is a characteristic feature of many solutions to the Einstein field equations. In this work we consider a spherically symmetric spacetime which is the non-static spacetime defined by the metric

$$g = dt^2 - dr^2 - e^{t-r}\left(dy^2 + \sin^2(y)dz^2\right) \qquad (*)$$

The wave equation on the metric (*) given by

$$u_t + u_{tt} + u_r - u_{rr} - e^{r-t}\cot(y)u_y - e^{r-t}u_{yy} - e^{r-t}\csc^2(y)u_{zz} = 0 \qquad (**)$$

will be studied where four new solutions of this equation will be obtained. The method that will be applied to solve this equation will be the Lie symmetries method where we will use the symmetries of (**) to reduce it to different PDEs in two variables then we will solve the reduced PDEs to obtain exact solutions of (**).

Department of Physics

Band Structure and Electronic Transport in Bilayer Graphene

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Abstract

In the few last years, graphene, a two dimensional one atom thick sheet of carbon atoms, rose in the horizon as a new star in the field of condensed matter. Its exceptional electronic, optical, thermal, and mechanical properties have potential of applications. Consequently, it becomes a hot research topic in these days. For example, its thermal conductivity is 15 times larger than copper and its electron mobility is 20 times larger than GaAs. In addition, it is considered as one of the strongest materials with a Young's modulus of about 1 TPa, some 200 times stronger than structural steel. The most important application of graphene is to replace the silicon IT technology in the future, but the biggest obstacle is to create an energy gap and control the electron motion in graphene taking into account the so called Klein tunneling which makes the task more complicated. Our goal is to use electric field, cylindrically symmetric electric potential (Wood Saxon Potential), on bilayer graphene to study the band structure, the localized states and its transport properties.

An attempt to investigate the elemental content of energy saving lamps using a very simple spectrometer

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Abstract

Summary: Energy saving lamps are more and more used in daily life. Some supermarkets are even solely selling them without the classical high energy consuming lamps. We have used a simple prism spectrometer used in a teaching laboratory for an Optics course at our university to try to study the elemental composition of some economy lamps. We used NIST lines with a helium lamp to calibrate our spectrometer. The minimal deviation was carefully measured for five unambiguous helium lines and their wavelength was taken from the NIST list. The relation between the wavelength of these lines and their minimal deviation constitute the calibration curve that we will use to find the unknown wavelengths in the spectra from the lamps.

Characterization of GAFCHROMIC EBT3 Film as a Radiation Dosimeter for Photon and Electron Beams

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Abstract

The purpose of this work is to investigate dosimetric properties of the latest Gafchromic EBT3 film released in 2011 for megavoltage photon and electron beams dosimetry. The films were placed in a solid water phantom and exposed to either photon or electron beams generated by a Varian CD2300 linear accelerator. All films were scanned using flatbed document scanner (HP Scanjet 4890). The dose response curves [net optical density (netOD) versus dose] were plotted and compared for red, blue and green channels. The results obtained show the red channel has the highest sensitivity in the low dose range (0-10 Gy), the green channel the highest sensitivity in the dose range of 10-50 Gy The blue channel was the least sensitivity in the dose range from 0 Gy to 50 Gy. We have observed that the film is energy independent for photon beams and energy independent for electron beams, but there is a difference in response between photon and electron beams of about 7-15%, the film scanning direction shows large difference (11-40%) between films scanned in the portrait and landscape orientations. The post-irradiation darkening of the film was investigated. After 2 hr the netOD values had stabilized to within 2% of their value at 24 hr. Our results show that the dose uncertainty of the EBT3 films for either photon or electron dosimetry, 2-3%, is within the acceptable radiation therapy dose uncertainty (□3%). Based on these results, the EBT3 film can be used for patient dose verification in radiotherapy photon or electron beams in the same way as the old Gafchromic film models (EBT and EBT2). Key words: Gafchromic EBT3 radiochromic film dosimetry film scanner calibration curve"

Utilizing Cold Heavy Polar Molecules for Precise Measurement of Electron Electric Dipole Moment (EDM)

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Abstract

During the last decade, the production and simultaneous spectroscopy of cold molecules has increasingly emerged as one of the most promising fields of research as it provides an unprecedented opportunity of combined extremely high resolution and precise measurement. Gaseous cold molecules behave quite differently from those at high temperatures due to their dominant quantum effects and minimal thermal vibrations. Many impressive advances in the field of cold molecules have inspired scientists to utilize cold molecules to tackle long standing challenges in physics. One of the hardest challenges in experimental physics is to measure the predicted by Standard Model (SM) theory to be infinitesimally small or non-existent value of electron electric dipole moment (EDM). As a direct consequence of CP symmetry violation the Standard Model theory and its extensions have set an upper limit of EDM value of 10^{-40} e.cm which is far too tiny to be measured with the current limit of experimental sensitivity one need to look beyond the Standard Model. The spectroscopy of heavy cold polar gaseous molecules (YbF, ThO) allow for elevated sensitivity in the EDM measurement which is expected to improve the limit of EDM value up to 10^{-27} e.cm (Hudson et al Nature 473 493-496 (2011)). In this paper, I will present a brief review of theoretical models related to EDM prediction and their limitation to determine EDM. Furthermore, experimental setups related to cold molecules spectroscopy and their potential to provide a precise measurement of EDM will be discussed along with the difficulties associated with each setup used up to date. Last but not the least, I will provide few suggested improvements for to reach a more accessible limit of electron electric dipole moment with reasonable uncertainty.

Mammography X-ray Machine X-ray Spectrum Simulation on Monte Carlo to Calculate Patient Dose

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Abstract

In this project, a Mammographic X-ray machine was simulated by using EGSnrc/BEAMnrc Monte Carlo software by which X-ray spectra for Mammographic X-ray machine operating at constant tube potentials of 30 kV was generated for a Molybdenum target and Molybdenum filter combination. The validity of X-ray spectra produced in this simulation was tested through comparisons with the experimental spectra of published sources. The results are in good agreement to the data obtained from these published sources and they can be applied to approximate dose delivered to patient by the mammography machine. The EGSnrc data for simulated Mammographic X-ray machine was used to estimate the fluence spectrum, energy fluence spectrum, air kerma, collision kerma and exposure in air.

Detection of Toxic elements in Cosmetic products using Laser Induced Breakdown Spectroscopy

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Abstract

The presence of heavy metals like lead and chromium, beyond the permissible levels in daily use of beauty products and cosmetics is of great concern. These heavy metals can be added as a by-product to the cosmetics during the manufacturing process or could be the natural part of the raw material. Lead can cause many dangerous health conditions such as disruption of the biosynthesis of hemoglobin, hypertension, kidney damage, miscarriages, disruption of nervous systems, brain damage and declined fertility of men through sperm damage. Lead poisoning in children is especially dangerous because it can cause learning problems and serious illness. Since blood borne lead crosses the placenta, a pregnant woman with an elevated blood lead level may expose her fetus to the toxic effects of lead. Laser induced breakdown spectroscopic (LIBS) system was developed using 266 nm laser and high resolution spectrograph (Andor SR 500 i-A) to detect the trace levels of the highly toxic metals such as lead and chromium present in different brands of talcum powder available in the local market. The strongest atomic transition lines of lead Pb (405.7 nm) and chromium Cr (425.4 nm) were used as spectral markers to simultaneously detect lead and chromium. The LIBS system was calibrated for these two heavy metals and the system was able to detect 15-20 part per million of lead and 20-30 part per million of chromium in the talcum powder sample. The limits of detection of the LIBS system were also estimated and it is 1.96 part per million and 1.72 part per million respectively for lead and chromium. This study is highly significant due to the use of cosmetic products which could affect the health of millions of people around the globe.

Evolution of the Magnetic State and the Possible Spin Liquid State in Fe2-xCrxAs System

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Abstract

The newly discovered iron-based superconductors exhibit various interesting transport and magnetic and structural changes at temperatures way above their superconducting transition temperature. Most notably incoherent charge transport above a magnetic spin density wave transition, typically found at TSDW ~150 K with overall behavior that significant deviates from Fermi liquid paradigm. Metallic states that deviate from Fermi liquid behavior are commonly found in many strongly correlated electron systems such as doped cuprates, quantum critical metals and disordered Kondo lattices. The recent discovery of such behavior in the no-superconducting, strongly correlated FeCrAs alloys posed several unanswered questions that may facilitate more understanding on the nature of the magnetic and superconducting state of the new iron based superconductors. We propose to investigate the evolution of the magnetic state in the partially substituted alloys (Fe1-xCrx)2As in an effort to produce the magnetic phase diagram for the system.

Exact solution of the susceptibity amplitude ratio in critical phenomenon

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Abstract

The susceptibility amplitude ratio with strong uniaxial dipolar interaction is calculated in the Gaussian model for two different cases. The crossover behaviour of the calculated ratio to the pure Gaussian isotropic point is discussed in terms of the crossover parameters. A comparison between our calculations and the available theoretical and experimental results is presented.

Two dimensional J-Matrix approach to scattering

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Abstract

In this talk we present the extention of the J-matrix method of scattering to two dimensions both in cartesian and cylindrical coordinates. In the J-matrix approach we select a zeroth order Hamiltonian H0 which is exactly solvable in the sense that we select a square integrable basis set that enable us to have an infinite tridiagonal representation for H0. Expanding the wavefunction in this basis makes the wave equation equivalent to a three-term recursion relation for the expansion coefficients. Consequently finding solutions of the recursion relation is equivalent to solving the original H0 problem (i.e. determining the expansion coefficients of the system's wavefunction). The part of the original potential interaction which cannot be brought to an exact tridiagonal form is cut in an NxN basis space and its matrix elements are computed numerically using Gauss quadrature approach. Hence this approach embodies powerful tools in the analysis of solutions of the wave equation by exploiting the intimate connection and interplay between tridiagonal matrices and the theory of orthogonal polynomials. In such analysis one is at liberty to employ a wide range of well established methods and numerical techniques associated with these settings such as quadrature approximation and continued fractions.

To demonstrate the utility usefulness and accuracy of the extended method we use it to obtain the scattering phase shift for an illustrative short range potential problem.

OMPARATIVE STUDY OF PHOTON PROBABILITY DISTRIBUTION FUNCTION FOR SQUEEZED STATES USING DIFFERENT ORTHOGONAL POLYNOMIALS

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Abstract

The photon probability distribution function of the squeezed states has been studied using different orthogonal polynomials such as: Bessel, Legendre, Laguerre, Chebyshev. Graphs for squeezed states are obtained for each orthogonal polynomial and compared with Hermit polynomial that has been used in literatures [1]. It is interesting to conclude that using different polynomials show the same behavior. [1] C. C. Gerry and P. L. Knight "Introductory Quantum Optics" 2006 Cambridge University press.

Synthesis of ultrafine (Nanoparticle) powders using pulsed laser ablation in liquids for various applications

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Abstract

There has been great demand for development of new techniques for the preparation of novel nanosized materials (powders) having unique properties for various applications such as catalysts high-strength ceramics fuel cells sensors and for harvesting the solar energy. The synthesis of ultrafine powders has been achieved mostly in the past by spray pyrolysis wet chemical synthesis vapor phase condensation rapid thermal decomposition of precursors in solution sputtering plasma reactors flame and furnace reactors laser-driven reactions. Some of these methods especially the chemical methods are capable of producing large quantities but they typically require many steps (pretreatment mixing chemical reaction filtration drying and heat-treating). Such treatments may alter the material purity promote grain growth and cause a lot of pollutants which further could cause the waste treatment difficulties and cost. Recently laser methods have been applied which gained high popularity since these methods allow one to obtain nanosized powders with a high degree of purity (as laser beams being a completely clean tool). The pulsed laser ablation (PLA) technique in liquid medium has been proven an effective and simple technique for preparing metals metal oxides metal peroxide nanoparticles. PLA technique for synthesis of nano sized materials from a solid target in liquid media has many advantages. Firstly this method is simple so it does not require costly chambers and high vacuum pumps and considered therefore as clean method. Most importantly it has been demonstrated that size of synthesized material can be controlled by changing different parameters such as: laser wavelength pulse laser duration changing the pH of the solution adding surfactants and changing the temperature of solution. These parameters not only change the size and shape of the nanoparticles but at same time they also change the optical and electronic properties.

Pulsed laser ablation technique has been applied for the synthesize of pure nano metal oxides like Al2O3 SnO2 CuO Cu2 O Bi2O3 TiO2 and ZnO. For this purpose a Q-switched Nd-YAG laser (Brilliant B) operating at 1064 532 and 355 nm wavelengths using fundamental second and third harmonic generators was employed. This laser can deliver maximum pulse energy of 900 450 and 200 mJ at 1064 532 and 355 nm respectively with a pulse width of 6 5 and 5 ns respectively and operates at a 10 Hz pulse repetition rate.

The oxide nanoparticles having nanometer grain size and quantum dots have been synthesized in aqueous solution in presence of different surfactants and solid targets. The effect of surfactants on the optical and structure of the material has been studied by applying different spectroscopic techniques. Structural properties and grain size of the synthesized nanoparticles has been studied using XRD method. For optical characterization UV-Vis spectrophotometer Photoluminescence Raman and FTIR transmittance spectrometry has been applied. In order to study the morphology of the as prepared nano sized powers FESEM and HRTEM imaging techniques were used. .

Magnetic and transport properties of Fe1-xCoxAs single-crystal

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Abstract

Soon after the discovery of the iron based pnictide superconductors, it was found that electron and hole doping elements (like Co and Mn respectively) on the iron site suppresses the magnetic order of the parent compounds and induces superconductivity. Most of the studies have been carried out using transition metal substitution in the superconducting phase, there is little effort have been devoted to evolution of the magnetic state and the phase diagram in the binary system FeAs. In this study we present susceptibility measurements along with transport measurements on the cobalt-substituted system Fe1-xCoxAs in an effort to construct the magnetic phase diagram of this system.

Magnetic and transport properties of Fe1-xCoxAs single-crystal

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Abstract

Soon after the discovery of the iron based pnictide superconductors, it was found that electron and hole doping elements (like Co and Mn respectively) on the iron site suppresses the magnetic order of the parent compounds and induces superconductivity. Most of the studies have been carried out using transition metal substitution in the superconducting phase, there is little effort have been devoted to evolution of the magnetic state and the phase diagram in the binary system FeAs. In this study we present susceptibility measurements along with transport measurements on the cobalt-substituted system Fe1-xCoxAs in an effort to construct the magnetic phase diagram of this system.

Synthesis of Hydrophobic Textures and Films as self cleaning surfaces using Spray Gun

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Abstract

The hydrophobic surfaces and coatings which promote low surface tension liquid repellency have a number of potential applications, including self cleaning fabrics and surfaces with resistance to wetting by water, surface coatings for reduction of bio fouling or fluid frictional drag and separation of oil/water dispersions. Any liquid placed on these coatings is repelled and simply rolls off without touching the underlying surface. A setup has been developed at our laboratory for fabrication of hydrophobic surfaces and textures which can enhance repulsion of water. It is worth mentioning that any surface having contact angle greater than 90 degree is considered hydrophobic and any surface having less than 90 degree is hydrophilic and this property depends on mainly on the surface roughness and surface energy. Superhydrophobic surfaces which exhibit a contact angle of q* > 150 and low contact angle hysteresis with water have been prepared by a number of techniques including lithography sole gel processing electrospinning electrodeposition and chemical vapor deposition methods. In this work we applied an alternate and cost effective technique to fabricate superoleophobic surfaces in a single step process by solution spraying of polymethyl methacrylate (PMMA) and fluorodecyl POSS blends dissolved in the hydrochlorofluorocarbon solvent THF under a pressurized nitrogen stream using spray gun.. An air brush (McMaster-Carr) with a nozzle diameter of 0.75 mm was connected to a compressed nitrogen tank (pressure P = 170 kPa) to spray coat the polymer solution at a distance of 20 to 25 cm onto the substrate. It was observed that the variation of the spraying distance within this range did not have a significant effect on the microtexture obtained and the spraying distance was fixed between 20-25 cm. The air brush was held fixed during the spraying process. The diameter covered by the conical spray jet at the substrate over the duration of the spraying was 7 cm in diameter while the size of the silicon wafer was 2 cm by 4 cm. Contact angle measurements to characterize the surface wettability were performed using a VCA 2000 (AST Inc.) and a Rame-Hart Model 590 goniometer. The advancing (q*adv) and receding (q* rec) contact angles were measured via the sessile drop technique upon adding and removing a total volume 10-15 mL of each liquid forming a drop with maximum diameter of 2.5 mm averaged over different locations on the coated substrate. The sliding angles were measured independently by tilting the stage.

The solution concentration and molecular weight of the dissolved polymer are critical in controlling the morphological characteristics of the microtextured surfaces generated using this simple spraying process. To demonstrate this we used three different POSS/PMMA solutions with solute concentrations (12.5 25 and 50 mg/ml) at a fixed fraction of 50 wt% fluorodecyl POSS and the duration of spraying was controlled to ensure that the total mass of the polymer blend delivered to each surface remained constant. At relatively low solute concentrations (12.5 mg/ml) the silicon substrate was completely covered by a corpuscular layer of spherical microbeads (~ 20 mm diameter). At a higher solute concentration of 25 mg/ml a transition to a beads-on-string morphology was noticed with individual fibrous strands of diameter < 1 mm and beads of diameter ranging from 20 mm to 50 mm. At higher solute concentrations (50 mg/ml) a dense fibrous mesh was produced with individual strands forming bundles of locally oriented fibers.

Department of Chemistry

Carbon nanostructures deposited on Silicon Carbide foams

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Abstract

Mass and heat transfer limitations in heterogeneous catalysis could lead to the loss of catalyst activity and selectivity, which in turn lower the reaction rates and lead to poor yield with high unwanted by-products. In order to improve mass and heat transfer rates, a novel catalyst support with high surface area, better oxidation and corrosion resistance, high chemical and thermal stability, porous materials with high surface area to volume ratio, low mass density, and high thermal conductivity is required.

In this present work, carbon nanostructure in form of carbon nanofibers (CNFs) having (20-100 nm) diameter and carbon nanobulbs of diameter (150-250nm) have been grown on 3-D silicon carbide (SiC) foam with the aid of interfacial oxide by using catalytic thermal chemical vapor deposition method (C-TCVD).

Textural properties were characterized by FESEM, XRD, RAMAN, BET to examine and determine the size and morphology, surface area, pore volume, crystallinity, and (I_d/I_g) ratios of CNSs.

The as-synthesized CNFs on 3-D SiC-foam shows promising results with high surface area in the magnitude above 100 m^2/g and minimal presence of micropores compared to conventional catalyst supports such as alumina, silica, silicoaluminates, and activated carbon. The highly porous catalysts can be applied to potential catalytic applications where classical amorphous carbon were used such as conversion of ethylbenzene to styrene, oxidation of H_2S to elemental sulfur, decomposition of hydrazine and NH_3.

Novel cross-linked polysulfonate-carboxylate resin for the removal of Cu^{2+} and Cd^{2+} from wastewater.

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Abstract

In this work, the adsorption of Cd^{2+} and Cu^{2+} from aqueous solutions was studied using a novel cross-linked resin containing sulfonate and carboxylate functionalities. The resin was synthesized by the reaction of N,N-diallyl-N-sulfopropylammonioethanoic acid, a cross-linker, 1,1,4,4-tetraallylpiperazinium dichloride, in the presence of tert-butylhydroperoxide in aqueous solution. The final resin was obtained upon treatment of the polyzwitterion with NaOH. The experimental data for the adsorption process fitted Lagergren second-order kinetic model and Freundlich as well as Temkin isotherm models. The adsorption process was spontaneous and endothermic in nature with negative and positive values for ΔG and ΔH respectively. The resin may be employed in the treatment of wastewater containing toxic metals such as Cd^{2+} and Cu^{2+}.

Synthesis and Characterization of Mononuclear Platinum(II) Complexes With Some Thione Ligands. X-Ray Crystal Structures of Tetrakis(Tetrahydropyrimidine-2(1H)-Thione)Platinum(II) Chloride and Tetra(1-Methylimidazolidine-2-Thione)Platinum(II) Chloride

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Abstract

The reactions of K_2PtCl_4 with 1-methylimidazolidine-2-thione (1), tetrahydropyrimidine-2(1H)-thione (2), 1-ethyltetrahydropyrimidine-2(1H)-thione (3) and 1,3-diazepane-2-thione (4) yield complexes of general formula $[PtL_2CI_2]$, and $[PtL_4]CI_2$. These complexes have been characterized by elemental analysis, ^{1}H and ^{13}C solution NMR, as well as ^{13}C, ^{15}N and ^{195}Pt solid NMR spectroscopy. The coordination site is discussed in the light of the various data obtained. Two of the complexes, $[Pt(MeImt)_4]Cl_2$ (**1B**) and $[Pt(Diaz)_4]Cl_2$ (**2B**), were characterized based on their X-ray crystallography and showed that the platinum atom is connected to four sulfur atoms; each belonging to thione ligand in a distorted square planar geometry.

New $[(thione)_2Au(diamine)]Cl_3$ complexes: Synthesis, Spectroscopic characterization and *in vitro* Cytotoxicity

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Abstract

Recent advances in oncology are focused on developing new complexes of gold (III) with a variety of ligands that show augmented anti-proliferative prospective and reduced toxicity as compared to *cis*-platin. In this study, new Au(III) complexes of the type $[(thione)_2Au(diamine)]Cl_3$ are reported, where thione = 1,3-imidazolidine-2-thione (*Imt*), 1,3-Diazinane-2-thione (*Diaz*) and diamine = diaminoethane (*en*), 1,3-diaminopropane (*pn*) or 1,4-diaminobutane (*bn*). The solid state IR as well as ^{13}C and ^{15}N NMR data indicate that Au(III) centre is bonded via sulfur of thiocarbonyl S=C< site of the thiones and also chelated by the diamines from the *trans* side of coordinated thiones. These new Au(III) complexes based on mixed thione and diamine ligands are almost similar with square planar structure of tetracoordinate $[Au(en)_2]Cl_3$ complex. In this study, cytotoxicity data for these gold (III) complexes against C6 glioma cell lines are also reported. As a result, some complexes show cytotoxicity comparable to *cis*-platin.

Comparison of anti-cancer activity of various gold (III) diamine complexes against PC-3 and SGC-7901

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Abstract

A novel series of Au(III) complexes of the type $[Au(L)_2]Cl_3$ (where L = *pn* and *N* substituted *en*) have been synthesized by reacting Auric acid ($HAuCl_4 \bullet 3H_2O$) with 2 equivalent of corresponding unsubstitued diamines or N-alkyl substituted ethylenediamine ligands. These complexes have been characterized by UV–Vis, Far-IR, and NMR. The stability of Au-N bonds was analyzed by vibrational frequency. The potential of anti-cancer activity of such complexes is evaluated through growth inhibitory effect against a number of human cancer cell lines. The solid-state ^{15}N NMR chemical shifts clearly indicate the strong diamine ligand coordination towards gold(III) centre via two N atoms. Examination of IC_{50} data for the various types of $[Au(diamine)_2]Cl_3$ complexes shows that some complexes are better agents than *cis*-platin against SGC-7901 cell line. The representative complex $[Au(en)Cl_2]Cl$ (**6)** has also been studied against ovarian cancer cell line and comparison made with *cis*-platin as anti-cancer agent. The seven member chelate $[Au(bn)Cl_2]Cl$(**8**) is found to be less effective against the SGC-7901 and PC-3 cell lines, when compared to $[Au(en)Cl_2]Cl$ (**6)** and $[Au(pn)Cl_2]Cl$ (**7).**

Determination of Haloacetic acids in swimming pool waters by membrane-protected micro-solid phase extraction

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Abstract

In this study, a simple and efficient extraction method for determining Haloacetic Acids (HAAs) in swimming pool waters has been developed. HAAs are most commonly detected in swimming pool and drinking waters at trace level concentrations. HAAs have proven to be health hazards to mammals and plants. For the first time, highly efficient sorbent was developed using rice husk waste material and used as sorbent for micro-solid phase extraction (μ-SPE). To increase the extraction capability of rice husk, iron oxide was incorporated via sol-gel process. In μ-SPE device, the novel sorbent was packed and used for extraction of HAAs prior to a ten minutes analysis using Ultra-high performance liquid Chromatography-ultraviolet detection (UPLC-UV). Only a small amount of sample and extraction solvent are required in this technique. To improve the performance of μ-SPE, various extraction parameters were optimized. Results demonstrate that the developed μ-SPE device using novel sorbent material renders an efficient tool for the precise and sensitive determination of HAAs in swimming pool water.

Simultaneous Extraction of Sulfur and Mercury from Fossil Fuels

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Abstract

Mercury is a trace component of all fossil fuels including natural gas, gas condensates, crude oil, and coal and tar sand. Mercury is one of the hazardous environmental pollutants that can cause central nervous system, kidney, and liver damage. At 25ºC mercury vapor can build up to 20 mg/m3 which is more than 10000 time higher than the guideline for air quality 1ug/m3 (1pg/L). During the refinery production, mercury in the crude oil can react with metallic surfaces, forming amalgams, impairing the proper operation of the equipment, and poisoning the catalyst. Low mercury content crude of course is preferable. However, due to increasing crude price, to maintain the profit margin the refinery plant had gone through few steps of technology upgrade so that high mercury content crude also can be processed. Tracking mercury level is essential for properly operating the plant.

Sulfur is another type of undesirable element present in the petroleum products. Removal of sulfur, therefore, is necessary to achieve better performance of petroleum products. Additionally, the release of sulfur leads to SOx pollution in the environment which is responsible for acid rains.

We know that Hg strongly reacts with S to produce HgS. Therefore for the first time we are proposing to remove sulfur and Hg simultaneously using porous membrane assisted electromembrane isolation (MAEI). The MAEI is a novel extraction procedure for the removal of more polar analytes. By using conductive acceptor solvents such as ionic-liquid and polar solvents, which will dissolve the sulfur and mercury, this procedure can be facilitated. Since ionic liquids have generally high boiling point, they can be reused after isolation of HgS from crude oil samples. In this proposal, we would like to focus on medium and heavy crude oil samples to develop this method

Detoxification of Chlorinated Benzene Compounds Using Fluidic Microreactor with Gas Chromatography/Mass Spectrometry

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Abstract

Chlorinated organic pollutants are persistent, toxic and ubiquitously distributed environmental contaminants. These compounds are highly bioaccumulative and adversely affect the ozone layer in the atmosphere. As such, its widespread usage is a major cause of environmental and health concern. Therefore it is important to detoxify such compounds by environment friendly methods.

In this work we utilized hydrogenolysis of chlorinated compounds using in-situ hydrogen donor and in the presence of RHA-10Pt and RHA-10Ti nanoparticles as catalysts. Low cost simple glass capillary microreactor was designed. The experiments were performed at ambience pressure and temperature. We have demonstrated, optimize the HDC reactions of chlorinated benzenes using a glass capillary-microreactor with high conversion and yields in comparison with the conventional method) and investigated the most favorable reaction conditions. The reaction was monitored by gas chromatography-mass spectrometry.

توعية الطلاب بأهمية الكيمياء

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مقدمة: سعيًا مني للقيام بدوري في نهضة المجتمع قمت بإعداد بحث متعلق بأساس النهضة وهو التعليم، واقتصرت على مادة الكيمياء لأجل تخصصي بها، والحمد لله على توفيقه، وأسأله أن ينفعنا بذلك.

مشكلة الدراسة: القطاع الصناعي يعاني من نقص في عدد الموظفين الكيميائيين كنتيجة لقلة عدد الطلاب المتخصصين في ذلك، فما سبب قلة إقبال الطلاب على التخصص في الكيمياء؟ وما الوسيلة لعلاج هذه المشكلة؟

المنهج المتبع في الدراسة: اعتمدت في البحث على إعداد وجمع عدد من الإحصائيات وتحليلها، كما اعتمدت–كطالب سابق في التعليم العام– على معرفتي بطريقة التعليم والوسائل الممكنة لتطويره.

النتائج والتوصيات:

- وجود نقص في طلاب قسم الكيمياء، والطلاب يمتنعون عن هذا التخصص لسببين أساسيين:
  - قلة اهتمامهم بالمادة، وذلك يتمثل في عدم معرفتهم بدور الكيمياء في الصناعة وعدم حبهم للعلم النظري.
  - وجود افتراض خاطئ في المجتمع أن تخصص الكيمياء غير جيد ولا يحصل خريجوه على وظائف جيدة.
- ليس الهدف من هذه الدراسة تغطية الحاجة إلى الكيميائيين فحسب، بل كذلك توعية الطلاب جميعًا بأهمية العلم في النهضة والتقدم، وتوجد عدة وسائل لتحقيق ذلك، ومنها:
  - تعويد الأطفال على تنفيذ التجارب العملية بإشراف من الأهل والمدرسة.
  - الإفادة من الحصص العملية بشكل أكبر.
  - الإفادة من البرامج المقدمة في القنوات العلمية.
  - تفعيل دور الشركات عبر أمرين: تكثيف الزيارات الطلابية لها، وإقامة معارض مدرسية عن منتجاتها.

Fe-N-MULTIWALLED CARBON NANOTUBE COMPOSITES AS ELECTROCATALYSTS FOR OXYGEN REDUCTION REACTION IN FUEL CELLS

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ABSTRACT

Non precious metal (NPM) catalysts based on carbon for oxygen reduction reaction (ORR) are promising alternatives for Pt based catalysts in fuel cells due to their low cost. However, their activity and durability still do not meet the fuel cell requirements. In this work, Fe-N-multiwalled Carbon Nanotube Composites was synthesized by coating polyaniline (PANI) on CNTs and heat treatment in ammonia. This material shows excellent ORR activity and durability during potential cycling in acidic and alkaline medium. The results demonstrated that CNTs supported non precious metal catalysts can be a promising low-cost cathode material for direct methanol fuel cell as well as for proton exchange membrane fuel cell and alkaline fuel cell.

Highly sensitive electrochemical detection of Ketoconazole at Glassy carbon electrode

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Abstract

Ketoconazole (KC) as a synthetic antifungal drug applied in different forms as a shampoo, cream and oral tablet is used to prevent and treat fungal skin infections. To detect KC, we selected electroanalytical techniques for its high sensitivity, low cost, clean and simple method for precise qualitative and quantitative determination. It is well known that electrochemical signal of electroactive molecules partially depends on type of electrode. To achieve high signal for KC electrooxidation, square wave voltammogram of KC electrooxidation at graphite pencil electrode, glassy carbon paste electrode, graphite carbon paste electrode and glassy carbon paste electrode were recorded. Among the tested electrodes, glassy carbon electrode shows highest signal. As a result, glassy carbon electrode was used to detect the KC under optimum pH and parameters of square wave voltammogram. Under the optimum condition, the electrode shows highly reproducibility for electrooxidation of KC with relative standard deviation 3. Besides, the concentration dependence study shows linearity range from 50 to 1000 ppb. The sensor allows the limit of detection and limit of quantification of developed sensor are 10.33 ppb (18.81nM) and 50 ppb (94.05 nM) of KC respectively. For the simplicity, low cost, high sensitivity, low detection limit, the developed sensor might be applicable for routine analysis of KC in pharmaceuticals, cosmetics, etc.

Alcohol free middle-phase microemulsion using mixed surfactant system of anionic and cationic with short chain hydrophobe

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Abstract

Phase behavior of systems containing sodium dodecylsulfate (SDS) as anionic surfactant and tetraethyl tetrabutyl ammonium halide as cationic hydrotrope in presence of water and pentane hexane and heptane were studied . Formation of microemulsion system from SDS and tetrabutyl ammonium bromide (TBAB) carried out at difference salt concentration .Anisotropy was detected by cross polarizer and polarized microscope .Ultralow interfacial tension for microemulsion was calculated theoretically by chun-hun equation micelles and inverse micelle were characterized by conductivity mesurment

The presence of short chain hydrotrope tetraethyl ammonium chloride (TEACl) was found to destabilize the liquid crystal region formed in mixed ionic surfactant system and increase the solubility of oil in micelles region and transparent gel formation .ultralow interfacial tension were found for micremulsion formulated with surfactant concentration 1%for SDS and TBAB (2:1) molar ratio respectively .

The effect of temperature that destabilized the microemulsion of system was measured and changing mole fraction and concentration of surfactant were studied .

The systems with anionic surfactant SDS are mostly used in wide range of detergency products and will be more efficiency with cationic hydrotrope and appliciaple in other non acceptable liquid crystal product .For alcohol free microemulsion were configured at low surfactant mixture concentration which applicable in the most applied and chemical processing such as EPR and SEAR were presence of alcohol limited there uses .

Synthesis spectroscopic characterization of AuNP in different solvents

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Abstract:

In this work, different methods were utilized to synthesize gold nanoparticles (AuNP's) in oleylamine as both reducing and monolayer capping agent. The influence of Au(IV)/reducing agent molar ratio, reduction's temperature, and period of reduction on the size distribution and shape of the produced AuNP were investigated. The AuNP formation process investigation was enabled based on standard UV-vis spectroscopy and transmission electron microscopy (TEM) analyses. The results indicated that the AuNP's size is affected by the molar ratio of Au(IV)/oleylamine, on the other hand the reduction's temperature influences the shape of the produced AuNP's. The concentration variation produced different sizes of the monolayer capped AuNP's of average diameters of 5-6, 9-12, and 22-25 nm. Moreover, different aprotic solvents were utilized to investigate the dependency of the UV-vis spectral maxima and absorption intensity of these particles on the solvent dielectric constants. The results indicated that in certain solvents, such as carbon tetrachloride (CCl_4), the small particles recombined together into larger and thermally stable particles with an average core size around 40-50 nm.

Adsorption of the Organic Dye Methyl Orange Using Activated Carbon Prepared from Waste Rubber Tires

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Abstract

Rubber tires disposed in a large amount every day all around the world represent a major environmental issue. Recycling waste rubber tires can be a solution that opens the door for butter utilization of these materials in various applications. This work reports tentative results of methyl orange removal from water using activated carbons (AC) developed from hard-to-dispose waste tires as efficient adsorbents. Carbon material from local waste rubber tires was thermally treated and activated. The tire-derived activated carbon was characterized by means of FTIR and dispersive Raman spectroscopic techniques. The vibration spectra were collected for non-activated carbon and for thermally activated carbon up to 900^{o}C. A number of bands centered at about 3350, 2350, 1710, 1650, 1300-1000 and 700 cm^{-1} prove the present of hydroxyl and carboxyl groups on the surface of AC in addition to enhanced C=C double bonds. The developed AC was tested and evaluated as potential adsorbent removal of methyl orange. A series of methyl orange stock solutions whose concentrations range from 1x10^{-6} to 1x10^{-4} M were prepared to investigate the possible activity of AC. Experimental parameters, such as dosage amount, initial concentration and temperature were optimized.

Application of electro-enhanced solid-phase microextraction for determination of phthalate esters and bisphenol A in blood and seawater samples

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Abstract

Electro-enhanced solid-phase microextraction (EE-SPME) method was developed for the determination of endocrine disruptor compounds such as phthalate esters and bisphenol A in human blood and seawater samples. After EE-SPME; samples were analysed by gas chromatography-mass spectrometry (GC-MS). In this approach, commercial SPME fiber was used in direct immersion mode with an applied potential to extract di-ethyl phthalate, di-butyl phthalate, benzyl butyl phthalate and bisphenol A. The applied potential facilitates and enhances the extraction efficiency of the target analytes. Various experimental conditions influencing performance of the EE-SPME such as extraction time, applied potential and ionic strength were optimized. Under the optimum conditions, EE-SPME was more effective than conventional SPME approach. Very good linearity was observed for all analytes in a range between 1 and 100 µg L^{-1} with coefficient of determination (R^2) between 0.963 and 0.996. The limits of detection based signal to noise of 3 were from 0.004 to 0.15 µg L^{-1}. The reproducibility of EE-SPME were evaluated, the relative standard deviations were between 1.0 and 5.0 % (n=9). The proposed method was applied to the human blood stored in transfusion bags and seawater. Results showed that the proposed EE-SPME was simple and suitable for trace level analysis.

Determination of phthalate esters in bottled water using dispersive liquid-liquid microextraction coupled with gas chromatography-mass spectrometry

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ABSTRACT

Dispersive liquid-liquid microextraction (DLLME) method was developed for the determination of the amount of phthalate esters in bottled drinking water samples and DLLME samples were analyzed by gas chromatography-mass spectrometry (GC-MS). Various experimental conditions influencing the extraction were optimized. Under the optimized conditions, very good linearity was observed for all analytes in a range between 0.05 and 150 μg L^{-1} with coefficient of determination (R^2) between (0.995-0.999). The limits of detection based signal to noise ratio of 3 were 0.005-0.22 μg L^{-1}. The reproducibility of DLLME was evaluated. The relative standard deviations were 1.3-5.2% (n=3). The concentrations of phthalates were determined in bottled samples available in half shell. To understand the leaching profile of these phthalates from bottled water, bottles were exposed to direct sunlight during summer (Temp from 34-57 ºC) and sampled at 12 hour intervals. Result showed that the proposed DLLME is suitable for rapid determination of phthalates in bottled water and di-n-butyl, butyl benzyl and bis-2-ethylhexyl phthalates compounds leaching from bottles up to 36 hr. Thereafter, degradation of phthalates was observed.

Civil Engineering Department

Development of Ultra-High Performance Concrete Utilizing Lime Stone Powder

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Abstract

The objective of this study was to attempt to develop ultra-high performance concrete (UHPC) using readily available local materials that has comparable performance to the currently available UHPC products. Several trial mixes were used to develop UHPC to obtain a compressive strength exceeding 150 MPa. The focus of this research was to develop UHPC utilize available materials which are abundantly available in the Saudi Arabia at little or no cost as a replacement of micro-silica which is very expensive ingredients of UHPC. Exploratory studies were conducted in an attempt to develop UHPC mix utilizing lime stone powder (LSP) that is locally available materials. The utilization of LSP in development of UHPC as a replacement of micro-silica would be beneficial from both economic and environmental perspectives. All the mechanical and durability properties of the developed UHPC were investigated.The results showed that with carefully selected and properly mixed ingredients it is possible to produce UHPC utilizing lime stone powder in Saudi Arabia with compressive strength in excess of 150 MPa in addition to excellent durability characteristics.

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

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ABSTRACT

Durability of concrete strutures and buildings adjacent to the shore and in the vicinity of marine environment is mainly affected by the ingress of chloride which initiates and accelarates corrosion of the reinforcing steel. Hence, prediction of the useful life of such structures depends on the adopted diffusivity used to model the transient problem of chloride migration into them. In literatures, however, such modeling is based on ideal and non-damaged diffusivity which is rare to be realistic as even under service loading part of the structures are subjected to damage in the tension zone especially for flexural members.

This paper makes a comparative assessment of the useful life by considering damaged and undamaged diffusivity. 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. A FORTRAN code was used to model the chloride ingress using fink's law with nonlinear diffusivity after incorporating damage. It has been found that the useful life reduced by a reasonable percentage as compared to the ideal case of using undamaged diffusivity. This calls for different specification of good quality concrete to account for the induced damaged and to prolong the life of the structures as intended.

Elastoplastic Response of a Pressurized Functionally Graded Tube

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Abstract

The use of special-purpose materials whose composition, structure and properties vary gradually over volume in order to be suitable for specific engineering function and applications has been gaining ground for many years. Such kinds of materials are referred to as functionally graded materials (FGM). They may be used to avoid corrosion, fatigue, fracture, stress corrosion cracking e.t.c. The response of these materials require a smart choice of solution techniques that are fast, easy to program in a computer, and yet produce accurate and reliable results with minimum possible effort. As a result numerical methods have been developed for modeling and simulating mechanical behavior of FGM.

This study addresses an approach to deal with the numerical simulation of both elastic and elastoplastic problem of a pressurized tube using the Radial Basis Function (RBF) approach with the aid of MATHEMATICA commercial software. Numerical example for utilizing this method is used to show the efficiency and reliability of the scheme. Excellent agreement with the available analytical result in the literature was achieved.

Self-Compacting Concrete: From Practical to Virtual Experiment

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ABSTRACT

To make an optimum use of Self-Compacting Concrete (SCC), simulation serves as a tool in the casting stage of the construction as well as determining the desired rheological parameters for a robust mix design of SCC.

The aim of this study is the development and validation of the flow of SCC made from limestone powder (LSP) using a continuum (single fluid) approach. Navier-Stoke's equations that govern the flow were used to obtain numerical solution of the problem using computational fluid dynamics (CFD) commercial software that enabled the tracking, in time and space, of material motion. The problem is characterized by free surface flow and the rheological behavior by means of a Bingham model which is modeled in the software package FLUENT for the Slump flow and L-box tests. A successful validation of the CFD simulations shows a good correlation with the experimental results from the literature.

SUSTAINABLE TRANSPORTATION STRATEGIES AND THEIR RELAVANCE IN SAUDI ARABIA

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Abstract

To date, Saudi Arabian government has invested substantially in the highway transport sector, and the present highway network is among the best in the world. But how sustainable is the system? Based on the current statistics there is more than 4.4 million rise in population from 2003 to 2011, along with forecasted increase from 108 to 224 in vehicle ownership per thousand citizens, in addition to all this there is a corresponding surge from 219,000 to 809,000 in new vehicle registered each year. It is obvious that if nothing is done to check the situation, the quality and capacity of the present highway network, especially within the municipality will be obsolete. Some key sustainable transportation strategies adopted across the globe and their relevance in the kingdom has been discussed. Current and future challenges in global transportation and how Saudi Arabian government should tackled them has been briefly highlighted.

Effect of Local Recycle waste on properties and performance of waterproofing asphalt mastic

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Abstract

Waste recycling is among the many options of disposing certain manufacturing and industrial by products. It serves two purposes; it eliminates possible health hazard and economic cost implications of the waste management process, as well as promotes the conservation of the scarce and diminishing non-renewable resources. In this paper, the effects of Oil-Sludge (waste from crude oil storage tanks), heavy oil fly ash 'HOFA' (combustion by product of heavy oil), cement kiln dust 'CKD' and limestone dust 'LMD' (waste from cement manufacturing) on the physical characteristic and performance of water proofing asphalt has been studied. Undue amount of the sludge weakens the asphalt bond strength. But there seem to be a positive interaction between the fillers (HOFA, CKD and LMD) and the oil-sludge in improving the asphalt properties. Result were statistically analyzed, and properties regression models were generated in terms of additive constituents. The sludge mastics yields potential material for water proofing and damp proofing application.

Effect of Composite Action on the Shear Strength of Steel 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. Composite beams under applied loads are often subjected to combined actions of bending and vertical shear. The behavior of the composite beam will be different from that of a plain steel plate girder because of the composite action between the steel girder and concrete slab.

This paper presents numerical evaluation of the shear strength of composite steel-concrete plate girder. Finite element modeling is used to evaluate the ultimate strength of composite steel-concrete simple span girder. The ultimate shear strength of the girder is evaluated analytically using AISC requirements and compared to the FE results. FE results verified using experimental results and showed good agreement. Results showed that the composite action improves capacity of steel plate girder to resist higher shear load as well as bending capacity. The composite action had more effect to increase shear capacity of composite steel-concrete girder with larger d/t web ratio. Web aspect ratio of composite steel-concrete plate girder affects the benefit of composite action of girders.

Compliance of Access Management Techniques on Urban Arterial in Nablus City

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Abstract

Development of any country now is related to the strength of the transportation sector. Although the level of technology in transportation varies and the needs and demands are expressed differently, the movement of people and goods is essential for human activities and production. Due to the increasing limitation of spaces and resources in most cities, there has been a growing trend in the management of the existing traffic system rather than building new facilities. Traffic management is a low cost improvement while constructing new facilities is capital-intensive and may be faced with the limitations of space and financial resources.

The main objectives of this project are to evaluate and explore the various measures of access management, to evaluate the applicability and effectiveness of some of these measures on one studied arterial. And to get a general idea of how the public will react to applying such measures using filed interviews with drivers, pedestrians, and business owners on the studied arterial.

After the discussion of the applicability of access management strategies, a set of access management criteria were adopted to be applied on the arterial. It is concluded that some of these measures can be easily applied on certain arterials, others can be applied with limited geometric improvements, and some measures could not be applied because they need large space. The interview results indicates that pedestrian recommendations conform to the main objectives of this study, drivers' indications did not conform to the main goals of this study, since they are local drivers and need a high level of accessibility. Business owners' indications did not conform to the main goals of this study also; they are concerned that changes in direct access to their property, such as closing driveways or installing raised medians, will lead to declines in sales.

Evaluation of Drivers Response to Variable Message Signs

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Abstract

Traffic congestion continues to grow on the Kingdom highways. Congestion includes recurring and nonrecurring components based on the primary cause(s) at any given period of time when demand exceeds capacity. One of the techniques that can be used to inform road users about the status of both recurring and nonrecurring congestion is variable message signs (VMS). Driver's behavior and response mainly change based on VMS content, whether to continue on the freeway or to choose an alternative road.

This study aims to evaluate drivers familiarity and response to VMS concerning route changing, and to evaluate the effect of their nationality whether it control the choice to adjust travel route based on certain messages provided on VMS. This will be done by conducting interviews with the drivers. The results of this study show 'from drivers opinion' that VMS have positive effect on enhancing road user's movement, and they have positive impact toward respond to information provided by VMS. In addition to that, the statistical analysis of the data showed that drivers from nationalities other than Arabs respond positively to VMS more than Saudi and Arabs drivers, drivers with driving experience less than 3 years respond positively to VMS more than others, while young drivers have less response to VMS than others.

Reducing of Roads Congestion Using Demand Management Techniques

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Abstract

Normally, people associate congestion with heavy traffic volumes, but it is not limited exclusively to roadways, other examples of congestion as overcrowded buses, trains, and commuter parking lots. Movement of people and goods are adversely impacts by traffic congestion. More delay in travel to motor vehicles and traffic operates less efficiently (motorist dissatisfaction), wasting fuel and increased levels of air pollution.

The main objectives of this research are to identify the possible congestion management techniques that are used around the world, and the softwares available to evaluate such techniques. The applicability and effectiveness of some of these techniques are then tested on available national and international data by comparing measures of effectiveness (capacity, LOS, delay, and speed) before and after applying these management measures.

It was found that some congestion management measures can be applied urban arterials, while others could not be applied easily. Also it was found that some softwares are more applicable than others when dealing with congestion aspects. Efficiency enhancement appeared in the road that congestion management techniques applied on.

RBF-based Meshless Method for the Analysis of Thin Plate Deflection with General Geometry and Boundary Conditions

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Abstract

The possibility of obtaining numerical solutions for Partial Differential Equations (PDFs) without resorting to element frame has been the goal of many researchers throughout the computational mechanics community for the past two decades. Radial Basis Function (RBF), as one of the most recently developed numerical techniques, so-called mesh free or meshless methods, has attracted attention in recent years. The key feature of the RBF method is that it is a truly mesh-free algorithm, which means that it is flexible with respect to the geometry of the computational domain.

RBFs have been used to solve partial differential equations related to various engineering applications. The approach has been used successfully for solution of the general bi-harmonic (fourth-order) differential equation that describes the problem of plate bending, which requires satisfying two boundary conditions, namely, deflection and slope of deflection. Literature review has concluded that the very well established shape-factor based RBFs (Multi-quadrics, Reciprocal multi-quadrics and Gaussian) are the most preferred functions among researchers nowadays.

In this paper, solution of linear plate bending problem will be presented with comparison between a k-based RBF function, namely, Multi-quadric and finite element method (FEM). Examples will be presented utilizing various geometric characteristics (elliptical, rectangular and triangular shapes) and boundary conditions, including combinations of simply supported, clamped, and free edges, which have not been previously addressed by related literature. In order to obtain a symmetric and non-singular linear equation system, the Hermite collocation method has been used as suggested by Leitao for solving the PDFs governing the Kirchhoff plate-bending problem in terms of the deflection.

Photocatalytic reduction of selenium oxyanions

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Abstract

TiO_2 Photocatalytic reduction of selenate and selenite were investigated using EDTA and thiocyanate as organic holes scavenger. EDTA was found to be very effective in the photoreduction of both selenite and selenate. It was able to reduce more than 95% of 20 ppm selenium oxyanions concentrations. Selenite photoreduction was found to be faster than that of selenate at all conditions. The photoreduction was found to be decreasing with an increase in the initial pH of the solution for both selenate and selenite. An increase in the initial concentration of EDTA lead to an increase in the photoreduction rate until a maximum value is reached after which the increase seized. The effect of initial concentration of selenate was also investigated. An increase in the photoreduction rate was also observed as the initial concentratioin of selenate was increased from 20 to 100 ppm. An optimum condition of pH 4 and 150 ppm EDTA concentration was obtained for the photoreduction of both selenate and selenite. However, thiocyanate did not perform well as an organic holes scavenger for the photoreduction of both selenate and selenite. It resulted in the oxidation of selenite to selenate. However, despite the high performance of EDTA and the low performance of thiocyande as organic holes scavengers, an addition of both EDTA and thiocyanate in a mixed system resulted in an almost complete photoreduction of selenate.

A Meshless Solution of Steady State Seepage Problem in an Orthotropic Medium under a Dam with a Degenerate Domain

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Abstract

This work presents a meshless solution using the methods of fundamental solution (MFS) for a problem of steady-state groundwater seepage under a dam in an orthotropic medium with degenerate domain. The meshless solution was implemented on Mathematica® platform, and a domain decomposition scheme was employed to handle the domain degeneracy. The results of the meshless numerical scheme were validated with the solutions of the finite element method (FEM) for the same problem. The MFS solution showed an excellent match with that of FEM, thereby offering an accurate solution to this important engineering problem with a much lesser computational cost.

A Review of Traffic Forecasting Process: Comparison of Parametric Techniques with Artificial Neural Networks

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Abstract

Traffic prediction involves forecasting traffic in terms of Annual Average Daily Traffic (AADT), Design Hour Volumes (DHV) and Directional Design Hour Volumes (DDHV). These forecasts are used for a wide variety of purposes from the planning to the design and operational stages of the highway network. The forecasting needs the historical traffic data as well as the systems characteristics, apart from that choice of an appropriate model or technique is also an important consideration. This paper gives an overview of the traffic forecasting process and the models that are used for this purpose with emphasis on the use of Artificial Neural Networks (ANNs) and other modern techniques. ANNs are being compared with the traditional Parametric techniques used in this regard. In the end, we conclude that ANN is found to be more suitable than parametric techniques like ARIMA in terms of their flexibility and implementation in real-world situations where all the required data may not be available all the time.

The effect of possible Failure of Dewatering System in the Eastern Province

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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.

Civil Engineering structures interact with soil through foundation. Once the building subjected to external forces or ground motion then, neither the structural displacements of the buildings nor the ground displacements, are independent of each other. Soil Structure Interaction (SSI) is the process in which the response of the structure is related to the ground motion. Unfortunately, conventional structural design methods neglect the effect of SSI. The SSI becomes effective for heavy structures that resting on relatively weak or soft soils as the high rise building, or other structures that required heavy buildings. Conventional structural design methods neglect the SSI effects

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.

EFFECTS OF PERIWINKLE SHELL POWDER AND LIME ON GEOTECHNICAL PROPERTIES OF LATERITIC SOIL SAMPLES

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ABSTRACT

Periwinkles are mass-consumables products which constitute relatively cheap sources of animal protein. Periwinkle shells contributed significantly to the increasing levels of environmental pollution. Periwinkle shell powder contains a considerable amount of calcium (iv) oxide (CaO) which can be used as a pozzolanic substance. Lime on the other hand is an expensive additive, which is constantly being used to stabilized soil in road constructions. This project work was carried out with a view to studying the effects of lime and periwinkle shell powder on some the geotechnical properties of lateritic soil samples.

Preliminary test analysis was carried out on two soil samples collected from Mokuro, Ile-Ife. This was done in order to properly identify and classify the soil sample used, then the soils samples were subjected to consistency limit tests (Liquid Limit, LL and Plastic Limit, PL) which involved addition of the varying proportion of lime (2, 4, 6, 8 and 10%) to the soil followed by introduction of the second additive which is periwinkle shell powder in proportions of 2, 4, 6 and 8%. Finally, the soil samples were subjected to engineering tests such as; Compaction test to determine the Maximum Dry Density (MDD) and the Optimum Moisture Content (OMC), CBR tests to determine the bearing strength as sub-base or sub-grade materials and the Triaxial test to determine the shear strength of the soil

The results of the study show that some mixes of both lime and periwinkle shell powder reduced the plasticity index of the lateritic soil samples, the lowest plasticity index occurred at 4% lime and 6% Periwinkle shell powder for sample A, the lowest plasticity index occurred at 4% lime and 8% Periwinkle shell powder (PSP) for sample B. Also, the addition of 4% lime and 6% PSP increased the MDD and reduced the OMC for sample A. The addition of 4% lime and 8% PSP increased the MDD and reduced the OMC for sample B. The unsoaked CBR value for sample A was reduced for all the mixed ratio, but The addition of 4% lime and 6% PSP and 4% lime and 8% PSP increased the CBR values for sample B. The addition of 4% lime and 4% PSP increased the shear strength of sample B. It can be concluded that 4% lime and 4% PSP can effectively stabilized lateritic soil that contains more silts, 4% lime and 8% PSP can effectively stabilized lateritic soil that contains more gravels.

Self-CuringConcrete

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Abstract

Curing is the maintenance of a satisfactory moisture content and temperature in concrete during some definite period to ensure that the degree of hydration is sufficient to reduce the porosity and develop the concrete microstructure in other to attain high strength, durability, water tightness, abrasion resistance, and resistance to corrosive actions of salt, plastic shrinkage, volume stability, freezing and thawing.

Self-curing concrete consists of coarse aggregates, fine aggregates, cement, and mixing water, and a self-curing admixtures such as propylene glycol (PG), polyethylene-glycol (PEG), dipropylene glycol(DPG), butylene glycol, neopenty glycol(NPG), xylitol, sorbitol, glycerine, phytosterols sodium pyrrolidone carboxylate, stearyl alcohol and acetyl alcohol, hyaluronic acid and polyethylene, these agents help in forming compound which help to reduce the water evaporation from concrete and thereby optimizing the water retention and also prevent excessive heat buildup that can lead to thermal cracking, it also improves the compressive strength of concrete compared to conventional cured concrete.

In hot weather condition where there are high ambient temperature, high concrete temperature, low relative humidity, high wind speed and high solar radiation, there is need to be more controlled by the selection of ingredients rather than by the uncertainties of construction practices and the weather condition. Instead of curing through external applications of water, concrete quality will be engineered through the incorporation of self-curing agents.

ERP Systems Workaround Practices: Barriers or Remedies

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Abstract

The purpose of this paper is to analyze and discuses IT workaround practices in two Saudi companies. The methodology used in this study measures the participants' feedback is using the "echo method. Most of the ERP system workaround is done from employees in the first company is not due to in the system as much as miss use of employees. In contrast, the main cause of workaround in the second company is not miss use of system as much as it is limitations in the ERP system. The ratio of total helpful example to total not helpful in the first company is 2.6 and in the second company is 1.07 which indicates an effective interaction between users and the ERP system.

Chemical Engineering Department

Synthesis of MTT type zeolite in a microwave reactor: effect of co-solvent

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Abstract

The use of microwave reactor in the synthesis of zeolites and other porous materials has gained popularity in the recent years. This is due to the shorter synthesis time, high purity and selectivity when compared to the conventional oven method. Our study focused on the growth of Mobile twenty three (MTT), a one dimensional zeolite by microwave irradiation in the presence of ethanol as a co-solvent. The effect of synthesis parameters such as co-solvent concentration synthesis time and agitation of precursor during microwave heat treatment was investigated. Synthesized samples were characterized with X-ray diffraction (XRD) and Field emission scanning electron microscopy (FESEM) to get an insight into the nature of products formed. Our study shows that co-solvent concentration and synthesis time affect nature of product formed. However, the formation of pure phase MTT zeolite was only possible with agitation.

ANALYTICAL STUDY OF LAMINAR FILM CONDENSATION ON HORIZONTAL FLAT PLAT; FILM THICKNESS AND VELOCITY

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Abstract

For infinite-size horizontal plates a steady state laminar film condensation studied when a hot vapor exists above the plate with higher temperature (saturation temperature) .Condensation will start creating laminar film with small thickness and slow horizontal velocity. In this study an explicit expression for film thickness and velocity is obtained analytically, also the conditions in which film thickness approach zero were investigated in the absence of any porous media.

Keywords: laminar film condensation, horizontal plate, infinite-size, film thickness, film velocity.

Kinetic modeling of *n*-butane dehydrogenation over CrO_xVO_x/MCM-41 catalyst in a fixed bed reactor.

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Abstract

The kinetics of *n*-butane dehydrogenation over CrO_xVO_x/MCM-41 catalyst was studied. The models were developed based on the catalyst tests carried out in a packed bed reactor at reaction temperature varied from 525-575°C under atmospheric pressure. XRD and physico-chemical characterizations were also performed. Nitrogen adsorption shows that the prepared catalyst is mesoporous with pore volume 0.66cc/g, pore diameter 25Å and surface area 1079m^2/g. The dehydrogenation of *n*-butane mainly gives butene isomers, 1, 3-butadiene and cracked products consisting of methane, ethane, ethene and propene. Based on the experimental observations, power law type models were formulated and parameters were estimated by fitting the experimental data implemented in MATLAB. The activation energy for the formation of butenes (96.2kJ/mol) was found to be considerably less than the activation energy for the formation of the undesirable cracked products (130.4kJ/mol).

Keywords*: n-Butane Dehydrogenation, Kinetic Modeling, Cracking, MCM-41, CrOx, VOx, Power Law, Activation Energy.*

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Oxidative dehydrogenation of *n*-butane over bimetallic mesoporous and microporous zeolites with CO_2 as mild oxidant

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Abstract

Oxidative dehydrogenation of n-butane was tested using carbon dioxide as a mild oxidant over bimetallic Cr-V supported catalysts (MCM-41, ZSM-5, MCM-22 and mesoZSM-5). The textural properties of the catalysts were measured by means of XRD, N_2 adsorption, SEM-EDX, Raman, H_2-TPR, NH_3 and CO_2-TPD techniques. The metal content of Cr and V was maintained around 1.2wt.% and 2.8wt.% for the catalytic test in packed bed reactor at different temperatures (525-600°C) for 180 min. 1.2Cr2.8V/MCM-41 and 1.2Cr2.8V/ZSM-5 exhibited maximum conversion of 14 % and 13.1%, respectively at 10 min and 600 °C. Significantly, high butenes selectivity was observed over MCM-41 (86.27%) than ZSM-5 support (58.1%). The mesoporosity in ZSM-5 had a negative impact on conversion level (7.1%) but improved the butenes selectivity slightly. 1.2Cr2.8V/M-22 showed the highest cracking ability leading to overall reduced butenes selectivity (57.9%). The study shows that over all catalysts, *n*-butane conversion is independent of CO_2 conversion. 1.2Cr2.8V/M-22 showed highest CO_2 conversion in the range 2.35-2.2% between 525-550 °C. The apparent activation energies of dehydrogenation and cracking reaction over the four catalysts were evaluated. The ratio of conversion to coke weight per cent over the four catalysts are observed in the following order: 1.2Cr2.8V/M-41>1.2Cr2.8V/Z-5>1.2Cr2.8V/mesoZ-5>1.2Cr2.8V/M-22.

***Keywords*:** Oxidative dehydrogenation; *n*-Butane; Mesoporous; Microporous; Bimetals; Zeolites, Carbon dioxide, Butenes.

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Energy Saving Opportunities for Crude Preheating Train of Heat Exchanger Network in Crude Distillation Unit

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Abstract

Energy saving opportunities in crude distillation unit has become significant due to its energy intensive nature and increasing high crude oil prices. This work shows how the applications of pinch technology lead to energy optimization opportunities of the heat exchangers network in CDU. The existing total demand of energy required by heat exchangers network (HEN) is 416.871 MMBtu/hr and 242.756 MMBtu/hr for heating and cooling utilities respectively. The existing investigation shows huge opportunity for reducing energy consumption with optimum minimum approach temperature of 50 ^{0}F. For achieving the minimum utilities requirements have used advanced composite curves and grand composite curve. The results were reduced of the hot utility about 42 MMBtu/hr at the furnaces (10 %saving) that leads to annual cost saving of energy consumption about 6416306 $/yr. Likewise, the scope energy saving for the cold utility is 42 MMBtu/hr (17.3% saving) that leads to annual cost saving of energy consumption about 336617.3$/yr. The total utilities cost savings about 6752923.3 $/yr.

Effects of acidity on the activity and product selectivity of HZSM-5 catalysts during ethylbenzene disproportionation and ethylation

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Abstract

This article deals with the effects of SiO_2/Al_2O_3 ratio of HZSM-5 catalysts in disproportionation and ethylation of ethylbenzene to produce diethylbenzene (DEB). The catalytic experiment in the CREC Riser Simulator shows that low temperature favors the EB ethylation reaction while higher temperature is favorable for disproportionation. The DEB selectivity was found to be significantly higher in ethylation of EB with ethanol than disproportionation. Among the three HZSM-5 catalysts, the sample with SiO_2/Al_2O_3= 80 gives highest EB conversion and is more selective to DEB although the p-DEB/m-DEB for the catalysts are comparable with other samples. The value of the activation energy for EB cracking is comparable to the activation energy of EB disproportionation which is consistent to the high benzene selectivity in this route. During the EB ethylation with ethanol, a small amount of benzene was formed via the cracking of product to DEB, which is reflected by higher activation energy of the DEB cracking reaction. The kinetics analysis also confirms that during EB ethylation the disproportionation and cracking of EB is negligible. In EB ethylation, the HZSM-5 catalyst with SiO_2/Al_2O_3= 80 requires lowest amount of activation energy to form DEB which is reflected in higher DEB selectivity of the catalyst.

EMOVAL OF PHENOL AND 4-CHLOROPHENOL FROM WATER BY CARBON BASED ADSORBENTS - ACOMPARATIVE ANALYSIS

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Abstract

Toxic organic substances are considered among the pollutants that have direct effect on humans and animals. Industrial wastewaters containing dissolved phenol and it's by product such as 4-CP, can contaminate groundwater resources and thus lead to a serious groundwater pollution problem. In the present research, the adsorption technique for the efficient removal of organic substances at trace level was employed. It is a mass transfer process that involves contact of a solid (adsorbent) with a fluid containing the target solute (adsorbate). Carbonaceous materials such as carbon nanotubes (CNT), activated carbon (AC), Industrial Fly ash (FA) and Carbon nanofibers are characterized by their extraordinary large specific surface area, well-developed porosity and tunable surface-containing functional groups. As a result, these carbon materials were utilized in this study as adsorbents for the removal of phenol and 4-CP compounds from synthetic contaminated water. Four parameters including pH (3-9) of the solution, agitation speed (50-250 rpm), contact time (0-12 hr), and adsorbent dosage (0-700 mg) were varied in order to determine their influence on the removal of Phenolic compounds from water and to investigate the influence of these parameters on the adsorption rate. The concentration of phenol and 4-CP in water before and after treatment was analyzed using UV-Spectroscopy. The experimental data were modeled by Langmuir and Freundlich and the adsorption capacity were obtained for each adsorbent.

ENHANCMENT OF PHENOL & FOUR CHLOROPHENOL ADSORPTION ON THE AQUEOUS SOLUTION BY MODIFIED ACTIVATED CARBON WITH METAL DIOXIDES

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Abstract

This laboratory study investigated the effectiveness of activated carbons (AC) impregnated by three different metal, Aluminum (AL), Titanium (Ti) and iron (Fe) for removal Phenol& 4-Chlorophenol from aqueous solutions. The study carried out at room temperature (22°C) .The optimum conditions for maximum adsorption in terms of, pH, shaking time, agitation speed, amount of the adsorbent, and initial concentration of the adsorbate were identified. The Batch kinetic and isotherm studies were carried out using the adsorption data for the removal by regular and modified AC with Aluminum (AC-AL).The result showed that the impregnation of AL, Ti and Fe metals enhance Phenol removal efficiency by AC, it was notice that the adsorption capacity increasing significantly from 1.35 (mg/g) for AC to 5.78 (mg/g) for AC-AL. Also it was notice that the adsorption capacity calculated from the kinetic adsorption was increased sharply from 4.68(mg/g) for AC to 5.405(mg/g) for AC-AL. The results showed that ,the removal efficiency of the AC impregnated with AL and Ti metals were enhance 4-CP adsorption successfully, while the Fe metal fail to enhance the activity of the AC to adsorb 4-CP from water. The adsorption capacity for remove 4-CP by AC increased from 1.51 (mg /g) to 3.546 (mg/g) for AC-AL and the adsorption kinetic was found follow first-order and Pseudo-second order models.

Heat Integration Analysis of Refinery Plant Using the Pinch Technique

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Abstract

In this work, energy integration of a heat exchanger network (HEN) of the Plant Refinery was carried out using the Pinch Analysis Technology through (heat-int) software. From the operating data, the HEN data was extracted, then the heat exchanger network data were analyzed through varying the pinch temperature and the amount of hot and cold utilities were observed. Also the effects of pinch temperature on the area of heat exchangers were done. The percentages of changing in hot and cold utilizes beside the area of heat exchangers were investigated and the percentages of utilities and area changing with pinch temperature were done. The main problem of the exiting heat exchanger network came from cross pinch temperature, seven heat exchangers with total energy of 183099704.2 *BTU\hr* crosses the pinch point that's violated the pinch rules. Cross pinch point with different pinch temperature was found to occur, so attention must be taken with these temperatures.

Study of the effect of synthesis parameters in reducing particle size of mesoporous Silica particles using Taguchi and Pareto analysis of variance.

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Abstract

The interest in the use of mesoporous silica nanoparticles (MSN) in the field of catalysis in has increased over the last decade due to its high surface area and thermal stability. Thus the need to developing techniques to achieve this nano-form of MS is of importance. In this study, we investigate the effect of synthesis parameters on reducing the size of MS using Taguchi and Pareto analysis of variance. Parameters investigated synthesis time, PH of solution of volume of tetraethylorthosilicate (TEOS) using. Data used in analysis were adapted from the work of Chiang et al [1]. From interaction plot observed using Taguchi analysis, we observed interaction between studied synthesis parameters. We therefore studied the detailed effect of selected process parameters alongside interactions between these parameters. Percentage contribution calculation using Pareto analysis of variance shows that the PH (B) of synthesis plays the most significant role with ~44% contribution. Approximately 23% each was observed for synthesis time (C) and the interaction between volume of TEOS (A) and PH (B) of solution (AxB). Volume of TEOS (B) used has ~10% contribution while, interactions AxC and BxC are of no significance with each having ~0.2% contribution.

THERMODYNAMIC MODEL FOR THE PREDICTION OF GAS CONDENSATE BEHAVIOR

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Abstract

In this study a model for accurate prediction of the phase behavior of the gas condensate had been developed. Peng-Robinson equation of state had been employed to estimate the fugacities of each component throughout all the phases. This method proved to be a strong tool in modeling systems with hydrocarbon components. The phase envelope, pressure-composition (P-x,y) diagram, Temperature-composition (T-x,y) diagram and (x-y) diagram had been developed. This results help to visualize gas condensate production path beginning from the reservoir to the surface which is essential to develop the optimum production schemes and strategies. Also, the proposed method can predict the phase behavior of different petroleum fluids.

Rheological and Thermal Behavior study of Non – Ionic Surfactant used in cEOR

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Abstract

The objective of my study is to the interactions between the Non-ionic Surfactants and polymers. Polymers and surfactants are used in the Enhanced Oil Recovery to increase the sweep efficiency by increasing the viscosity of the water and decreasing the Interfacial Tension between water and oil respectively. Research will be conducted on different formulations of surfactant and polymers and vary different parameters. With the help of these research results we shall be able to optimize the particular formulation of SP system for specific conditions. Effect of different types of surfactants and polymer blends on rheology and thermal stability will be observed and so the best system will be recommended. Salinity and salts affect the viscoelastic properties of SP system so the optimum salinity which gives the best results will be preferred. Effects of temperature, Pressure and Shear rate will be studied and recorded for further use in future.

After all these results analyzed and logged, one will be able to use the best SP system for particular application. As carbonate reservoirs which contain 60% of oil in the world, are still to be treated. After this research, it will help to select the best system to recover maximum oil from these reservoirs and also from others as it will help to understand which system will perform best under specific conditions.

Isothermal Vapor Liquid Equilibrium for 1,1-difluoroethane (HFC-152a) and n-butane (R-600)

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Abstract

The isothermal vapor liquid equilibrium for the binary system of 1,1-difluoroethane (HFC-152a) and n-butane (R-600) is correlated at six different temperatures (273.15, 283.15, 293.15, 303.15, 313.15, and 323.15) K, using the ϕ-ϕ formulation approach, and using two different equation of states namely, the Peng-Robinson equation of state (PR-EOS), using the Wong-Sandler mixing rule and Carnahan-Starling-De Santis equation of state (CSD-EOS). The azeotropic pressure and composition at each temperature are calculated and a polynomial giving the azeotropic pressure in this temperature range is obtained, also a linear relation for the azeotropic composition versus temperature is found. It was found that, Peng-Robinson equation of state with Wong-Sandler mixing rule, better fits the experimental data than the Carnahan-Starling-De Santis equation of state (CSD-EOS), in the temperature range studied.

CO2 mitigation by different microalgae species using photo bioreactor

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Abstract

As CO2 is a major environmental concern worldwide lot of research is being done for the mitigation purpose with different techniques and technologies. Biological CO2 capture methods using photo-bioreactors by growing microalgae, which is the current potential technology being explored worldwide due to its advantages of CO2 capture coupled with wastewater treatment as well as biofuel production. As in the Middle East countries especially in Saudi Arabia region has large power plants as CO2 sources and wastewater treatment as nutrients sources for microalgae with desalination plants could be as salts reuse source with solar irradiations as extra advantage. In this work with the purpose of CO2 reduction using photo-bioreactor two species of microalgae i.e Chlorella Vulgaris and N. Oculata were cultured in four different sets of photo-bioreactors with CO2 concentrations of 2%, and 4%, to study the growth kinetics, effect of cell density on growth, biomass production and CO2 reduction by providing constant fluorescent light also effects of pH changes were studied on during culturing media. The result shows that for same CO2 concentration, the growth rate of Chlorella Vulgaris is higher than N. Oculata for higher CO2 provision. On the other hand N. Oculata growth is favored by more salty media and lower CO2 ratios. It was also observed that with increase in CO2 concentration, CO2 removal efficiency deceases. These results of this study will be helpful to define optimum operating parameters for culture developing of Chlorella Vulgaris and N. Oculata with maximum CO2 utilization.

Rheological Investigation of Interaction between Anionic Surfactant and Polyacrylamide for Chemical Flooding in Saudi Arabian Reservoirs

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Abstract

Economy of Saudi Arabia is heavily dependent on oil and petroleum products. Its average oil production is about 10 MMBD with a production capacity over 12 MMBD. Therefore, it is very important for Kingdom to maximize oil recovery from current reservoirs. By using primary oil recovery techniques only one third of original oil in place can be recovered. To recover remaining two third oil enhanced oil recovery (EOR) techniques are required. In future, with the depletion of oil reservoirs there will be no choice but to implement EOR. Most widely used EOR methods include thermal flooding, gas flooding and chemical enhanced oil recovery (cEOR). Chemical used in cEOR are: surfactant, polymer and alkalis. Polymers are used to increase the viscosity of water used to displace oil. Surfactants reduce the interfacial tension between water and oil while alkalis are used for in situ generation of surfactant and adjusting pH. In this work effect of surfactant concentration, polymer concentration and salinity was investigated by using rheological measurements. Discovery hybrid rheometer (DHR-3) was used to study the rheological properties of surfactant-polymer (SP) solutions. Copolymer of acrylamide and acrylamido tertiary butyl sulfonic acid (ATBS) was used with a commercially available anionic surfactant sodium dodecyl sulfate. Addition of surfactant was decreasing the viscosity of SP solution. Surfactant was successfully able to decrease the interfacial storage modulus at oil/water interface. SP solutions showed precipitation in the presence of divalent cation but with monovalent cation this SP system performed well. On the basis of obtained results this SP system is recommended for reservoirs with low divalent cations.

Impact of Molecular Structure on Thermal Stability of Water Soluble Polymers Used for Enhanced Oil Recovery Applications

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Abstract

Production of incremental oil from enhanced oil recovery (EOR) techniques will contribute a significant portion of total oil production in Saudi Arabia. One of the promising EOR techniques is chemical flooding that has successfully been implemented in some oil fields of world. To date chemical flooding has not been used in Saudi Arabia. Polyacrylamides are widely used in polymer flooding to increase the viscosity of displacing fluid to recover residual oil from reservoirs. One of the major disadvantages of these polymers is the hydrolysis of amide group at elevated temperatures. Presence of oxygen can further accelerate this process. In presence of salts, this thermal instability causes a major reduction in viscosity of polymer from the time it was injected to breakthrough. The objective of this work was to evaluate the thermal stability of different polyacrylamide-types of polymers with different molecular weight and molecular structure. Thermal behaviour of polymer solutions was also investigated in presence of surfactant. Arrhenius model was applied to calculate activation energy of viscous flow and pre-exponent factor for different surfactant- polymer (SP) solutions. State of the art Discovery hybrid rheometer (DHR-3) was used for measuring viscosity and other rheological properties. On increasing temperature, viscosity decrease was high for partially hydrolyzed polyacrylamide (HPAM) as compared to copolymer of acrylamide and acrylamido tertiary butyl sulfonic acid (ATBS). Aging of samples was also done at 80^{o}C for specific period of time and viscosity at different shear rate was calculated before and after aging. After aging period, low and high molecular weight HPAM showed a major reduction in viscosity. Viscosity retention was high for ATBS copolymer as compared to HPAM after aging at high temperature. No precipitation was observed within the experimental temperature range for SP solutions.

Review: Removal of Hydrogen Sulfide from Air and Water

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Abstract

This study covers comprehensively the wide range of mechanisms available for hydrogen sulfide removal from air and water. Physicochemical processes, chemobiological processes, biological processes, removal by oxidizing with ozone, selective and non-selective desulfurization based on precipitation reaction, removal of hydrogen sulfide by adsorbents, such as metal oxides and activated carbon, biofiltration, addition of iron salts or precipitation of ferrous sulfide, addition of H2O2 or chlorines and similarly formaldehyde or para-formaldehyde and nitrate or nitrite are elaborated. Different methods for removal of H2S from air and stack gases like scrubbing, carbon adsorption, chemical and thermal oxidation, Claus process and removal using activated carbon are also discussed at length.

A Decision Tool for SO_2 Reduction in Power Generation

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Abstract

Enormous amounts of sulfur oxides emitted from the power generation sector every day due to burning of fossil fuels in these stations. The negative effects of SO_2 emissions are their contribution to the formation of acid rain and their adverse effects especially on human health and environment in general.This study aims to find a decision support and scientific tool that can be used to select the best pollution control strategy for the power generation to reduce SO_2 to a targeted concentration while meeting the electricity demand at minimum cost. An optimization approach for three mitigation alternatives was developed to achieve our target. The developed model was written in a general format and illustrated in a case study that can be applicable for Saudi Arabia in the future.

Novel Approach to Control Properties of Polyethylene and Polyethylene/ Polypropylene Nano-Composites

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Abstract

Polyolefins are a fast growing sector of the polymer industry with the highest amount of nearly 4 million tons a year. The introduction of the metallocene catalysts has added a new chapter in the history of polyolefins. In this study, a vanadium (III) complex bearing salicylaldiminato ligands of the general class $[RN=CH(ArO)]VCl_2(THF)_2$ where Ar is C_6H_4 and R = Ph, was synthesized. Undoped titania nanofillers were synthesized by a modified sol-gel process, in addition to nanofillers formed from titania doped with iron. Titanium dioxide doped with iron (TiO_2/Fe) was investigated to study the effect of nanofillers on the ethylene hompolymer and ethylene/ propylene copolymer properties. To our knowledge, this is the first time titanium dioxide doped with iron has been used as a nanofiller in ethylene polymerization and ethylene/propylene copolymerization using vanadium complex catalyst (V) with methylaluminum dichloride (MADC) as a cocatalyst. The weight average molecular weight (Mw), molecular weight distribution (MWD), catalyst activity, copolymer composition, crystallinity and thermal characteristics of polyethylene and polyethylene/polypropylene nanocomposites have been investigated. This work is of significant importance to academia and industrial sectors due to its potential applications.

METATHESIS OF 2-BUTENE TO PROPYLENE OVER TUNGSTEN OXIDE SUPPORTED ON MESOPOROUS MATERIALS: DEVELOPMENT OF CATALYST

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ABSTRACT

Olefin metathesis is one of the very few fundamentally novel reactions discovered in last 40 years. This technology is now using for the production of one of the most important petrochemical "propylene", which is called as olefin of future. Metathesis of 2-Butene to produce propylene over tungsten oxide supported on mesoporous catalyst was studied. Mesoporous silica (MCM-41 & SBA-15) having tungsten oxide in the frame work were synthesized by hydrothermal crystallization process using CTAB and P123 as structure directing agents respectively. Tungsten oxide supported on mesoporous silica (MCM-41 & SBA-15) catalysts were also synthesized following wet impregnation method for comparison purpose. The synthesized catalysts were characterized by XRD, N_2 adsorption-desorption, NH_3-TPD and Raman spectroscopy instrumental techniques. A fixed bed tubular reactor was used to carry out all the experiments at different operating condition. The reaction temperature was varied from 450-550 °C and GHSV was fixed at 900 hr^{-1}. The results have revealed that catalysts having tungsten oxide in the frame work of mesoporous silica exhibited higher metathesis activity as compared to that of tungsten oxide impregnated catalysts. Catalysts based on MCM-41 have much higher activity at low temperature (450 °C) as compared to that of SBA-15.

ISOMERIC EFFECT IN ETHYLENE/1-HEXENE AND ETHYLENE/4-METHYL-1-PENTENE COPOLYMERIZATIONS WITH SUPPPORTED MAO/METALLOCENE SYSTEMS

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Abstract

New supported methyl aluminoxane anions were designed on mesoporous silica (catalyst 1) or on functionalized mesoporous silica (Catalyst 2) and subsequently used to heterogenize metallocene precatalyst, bis(n-butylcyclopentadienyl) Zirconium chloride [(^{n}BuCp)$_2$ZrCl$_2$]. The resulting catalysts systems were used to synthesize ethylene homopolymers, ethylene/1-hexene and ethylene/4-methyl-1-pentene copolymers. The level of comonomer incorporation and ethylene sequence length along the copolymer backbone were determined via triad calculations according to Seger-Maciel algorithm using data obtained from ^{13}C NMR of the samples. Random parameters were also determined from same to ascertain the tacticity of the copolymers. The samples were thermally fractionated using successive self-nucleation and annealing (SSA) technique. Coincident peak fractionating temperatures of 106.48, 111.12, 115.40, 119.48 and 124.69 ^{O}C were observed for both copolymers synthesized using catalyst 1, while those obtained with catalyst 2 showed similar trends at 106.81, 110.99, 115.34,119.34 and 124.28 ^{O}C. The coincident temperatures are what we expected from copolymers produced by the same catalyst active centres while the slight difference in the temperatures signifies the difference in MAO cocatalyst anion designs. The isomeric effect was shown vividly in the lamellar thickness distribution.

Hierarchical zeolites for liquid phase alkylation of Benzene with Dodecene: Effect of Desilication

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Abstract:

Commercial mordenite having Si/Al ratio of 20, 40 and beta zeolites of Si/Al ratio 24, 39 were tested at 140^0C, 300 psi and $4hr^{-1}$ for alkylation of benzene with dodecene having a molar ratio of 6:1. The aforementioned zeolites were deslicated, characterized by XRD, Pyridine adsorption and FTIR. Experimental results revealed that under the given operating conditions, mordenite (Si/Al = 20) exhibited superior activity with high conversion of dodecene (98%). The selectivity of phenyldodecane (Linear AlkylBenzene) isomers was 97%. After desilication, Beta (Si/Al = 24) showed a significant improvement in conversion and LAB isomer selectivity. Also the effect of temperature and space velocity on conversion of dodecene using mordenite was studied.

Heterogeneous modeling of a fixed bed water gas shift reactor

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Abstract

Recently the demand for highly pure hydrogen gas has been increased significantly with the development of fuel cells. Production of hydrogen gas from synthesis gas through water gas shift reaction is one of the most common processes. This work represents the analysis of concentration and temperature profiles for water gas shift reaction. Kinetic data for the reaction is obtained from literature. The mass and energy balance equations for this system are modeled and solved to estimate the temperature and concentration profiles inside the catalyst pellet as well as outside the pellet. The effect of bulk temperature on the external and internal concentration difference and effect on external and internal temperature difference is studied. The results obtained in this study are in close agreement with the data in literature.

Study of Vapor Liquid Equilibrium of Binary Mixture of Ethyl Acetate and Ethanol Mixture

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Abstract

Vapor liquid equilibrium data of mixture gives significant information regarding the separation process of components, such process is important in many petroleum and petrochemical industries. In this study, vapor liquid equilibrium data for binary mixture of ethyl acetate and ethanol was generated using thermodynamics modeling. The calculations were based on activity coefficients approach, using Wilson and Van Laar Model. x-y diagrams, isobaric T-x-y diagrams and isothermal P-x-y diagrams were produced and compared with experimental results in the literature, the predicted data showed very close agreement with the experimental data. The activity coefficients calculated by the models also showed a consistent agreement with the experimental data. The effect of pressure and temperature upon the azeotropic composition was also studied, which showed that azeotropic composition shifts to a lower value upon a rise in temperature and pressure.

Enhancement in corrosion resistance of waterborne polyurethane coatings on steel substrate by addition of carbon nano tubes

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Abstract:

Solvent borne coatings are expensive and not environment friendly due to emission of toxic volatile organic compounds (VOCs). In order to counter these problems the waterborne coating systems have been introduced. Waterborne polyurethane (WBPU) is considered one of the industrially important polymers now days. In the present study, WBPU coatings of 100 μm thickness were prepared. Next, nano composite of WBPU was developed using carbon nanotubes to compare the resultant properties with unfilled WBPU. Three different concentrations (0.5, 1, 2 wt. %) of CNT were used. FTIR characterization was done to monitor any changes in the functionality due to addition of CNT. Samples were monitored periodically during this period and visual inspection was carried out and photographs of the surfaces were taken by high resolution camera. After 100 days of exposure, the inspection of the two coating systems was carried out and it was observed that unfilled WBPU samples showed much greater extent of deterioration as compared to the CNT filled coating samples under natural atmospheric conditions. The results were confirmed by using DC polarization technique.

Electrical Engineering Department

A Cooperative Spectrum Sensing System Using an Improved Evidence-Based Approach

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Abstract:

Spectrum sensing is a key technology in wireless communications. One of the major problems in spectrum sensing is the uncertainty of single Secondary Users (SU) decisions resulting from channel conditions like fading, shadowing and time shifting. Cooperative spectrum sensing can mitigate this problem by using diversity strategies. The original Dempster-Shafer Theory was shown to be a powerful combining method that can be applied to mitigate uncertainty, but it suffers from two main disadvantages: The first one is that all SU's are treated equally at the Fusion Center (FC) without considering the reliability of the sensing information they can supply. The second issue is the complexity of the traditional Dempster-Shafer which increases exponentially with the growing of evidence. In this paper, the performances of traditional and our improved Dempster-Shafer rules are compared to that of the OR rule. The simulations show that Dempster-Shafer rules outperform OR rule at very low Signal-to-Noise ratios.

Enhancing RSSI-Based Distributed Clustering Using Transmit Power Control

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Abstract:

Energy-efficient distributed clustering algorithms focus on increasing the life time of the wireless sensor network by minimizing the number of cluster heads (while maintaining small overlapping between clusters) and by load balancing. Most of these algorithms, even the new ones, depend on communicating the location information between nodes and on some kind of voting to find the best selection of cluster heads. On the other hand, RSSI-based clustering algorithms don't require the nodes to find their own locations or to communicate it with other nodes. They don't also require voting to choose cluster heads. In this paper, we compare an RSSI-based clustering algorithm (RFSS) to LEACH and prove that it achieves better performance in terms of overlapping between clusters and the number of non-associated nodes. We suggest an enhancement to the performance of RFSS in terms of decreasing the overlap area between clusters using Transmit power control (TPC).

Substation Automation System Based on IEC 61850

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Abstract

Interoperability is the main problem faces the electrical companies specially when the electrical substations are extended using devices from different sources. This problem appears because each manufacturing company depends on a different communication technology between Intelligent Electronic Devices (IED), so IEC 61850 standard was put to solve this problem and to be worldwide among the vendors. This standard depends mainly on the networking technology and its features. Ethernet technology was used in this type of substation automation for its features and properties. Ethernet switch is one example of the equipments added in the system. IP is an example of this feature and each IED has its address. Band width of the Ethernet is large and its Speed can be varies from Mbps up to Gbps, so a lot of information can be transferred at the same time, in contrast to the old protocols that depends on the small bandwidth, less configuration and wires are needed even it depends on LAN technology and it is not important to configure each point in the system. Any extension can be done without any problem because its impact and reconfiguration is low if it is existed. This report describes substation automation principles, benefits and data model of information collected to monitor, protect and control the system.

Compressed Sensing based schemes to mitigate nonlinear distortions in WiMAX Physical Layer

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Abstract:

In this paper, compressive sensing (CS) based schemes are presented for estimation and cancellation of nonlinear distortions caused by power amplifiers (PAs) in the uplink of fixed WiMAX (IEEE 802.16d) system. To keep the spectral emissions within the mask, digital predistorter (DPD) is used at the transmitter. The linearized PA at the mobile terminal is then over-driven for power efficiency boosting, resulting in clipping distortions. At the receiver, two different CS schemes namely: convex relaxation and fast Bayesian matching pursuit (FBMP) are used to mitigate the clipping distortions. The proposed technique is validated on a handset commercial PA evaluation board. The amplifier was experimentally characterized using OFDM based test signals. The measurement results were used to build a realistic accurate behavioral model to simulate the amplifier in the transmitter path. The entire transmitter/receiver chains were build in Agilent's Advanced Design System (ADS) Software according to the above mentioned WiMAX standard. The bit error rate (BER) and error vector magnitude (EVM) results obtained using the two CS techniques proposed in this work illustrate the ability of CS schemes to compensate for distortions at the receiver and allow for high operating efficiency of the transmitter which is in line with the current trend toward green communication systems.

Arabic Handwriting recognition using Combining Classifier Neural Networks

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Abstract

Multiple classifier system (MCS) is a method used to combine individual classifiers to form new systems. It has already been applied in character recognition in different languages, however few was done when it comes to its application in Arabic character recognition. As there is always a trade-off between achieving a better recognition rate and the simplicity of the system, most of the research carried out in this field end of with complex systems to be able to achieve a very good recognition rate. In this study, we develop a less complex system using radial basis function (RBF) and Multi-layer perception (MLP) neural networks to achieve a better performance compare to known existing methods. We also utilizes the great features of Hu-moments to extract the feature as it is invariant to either rotation, translation or even scaling and this speed up the preprocessing stage. We also used IFN/ENIT database in comparing the proposed system with the existing ones.

“Efficient and High-speed License Plate Recognition”

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Abstract

Automatic license plate recognition (LPR) system has been an important research issue. A license plate recognition system consists of three main parts: license plate localization, character segmentation, and character recognition. Amongst these, crucial part and the most important is the license plate localization. In this study a method for license plate localization is discussed. The proposed algorithm makes use of the rich edge information in the plate area. First of all, some parts of the car image are enhanced to minimize the effect of the environment. In the second step the vertical edges are extracted by using the Sobel operator. In the next step, long and short edges are removed because these edges represent the background noise and curves by using concerned neighborhood pixels’’ (CNP). Final step is to get the license plate from the final image obtained after the removal of the non-plate edges. The proposed algorithm has been tested on a big set of image database under different environmental conditions. The detection rate of the proposed algorithm is more than 90%.

"No-Reference Image Quality Assessment using Noise and Blur"

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Abstract

The increasing popularity of camera function in different products has made it absolute necessary to develop No-reference image quality assessment. For image quality assessment, conventional method like Peak Signal to Noise Ratio (PSNR) or Mean Square Error (MSE) requires a reference image. In this study an image quality assessment method is described which doesn't require the reference image. This method takes blur and noise of the image to assess the quality. With the advancements in the digital cameras the image acquired from them have only a few blocking and ringing artifacts so the four parameters blur mean, blur ratio, noise mean and noise ratio are enough for the assessment. The proposed model was compared with Wang method. Proposed model outperforms the Wang model (well-known NR image quality evaluation system) and gives a better correlation with the difference of mean opinion scores (Original values) than Wang. Proposed model has even better correlation than the peak signal to noise ratio which is full reference image quality assessment technique. Much better results than the existing no-reference image assessment methods were obtained.

Emission-aware Energy Trading by Coordinating Thermal & Wind Power Generation

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Abstract

In this work, combined trading of energy and emissions for coordinated wind and thermal units is considered. The objective is (a) to maximize the expected profits of the owner using coordination as risk mitigation and (b) to minimize emission. A two level mixed integer stochastic programming (SP) is used to handle various uncertainties. Simulation results show the benefits of using a combined bidding strategy for wind and thermal units along with emission reduction.

This research problem is built on a previous work which coordinates wind and thermal and incorporates the V2G services as a tool for mitigation of risks. In this work, a generalized optimal bidding strategy has been proposed by coordinating both wind and thermal generating units in a day-ahead energy market, taking into account the emissions from thermal units. The target is to **(a)** mitigate the risks associated with wind power generation through coordination with thermal incorporating CVaR **(b)** and at the same time maximizing the profits of GENCO by (i) coordinated bidding in electricity market (ii) and selling emission allowance in emission market as described by European Union (EU) Emission Trading Scheme (ETS).The problem is formulated as a mixed integer linear program (MILP) that determines the optimal bidding curves for wind and thermal units and the optimal thermal unit commitment schedules based on profits maximization and emission minimization. The uncertainties of wind power outputs, energy prices, and imbalance prices are included. The objective is to obtain the optimal trade-off bid offers that increase the expected profits, reduce risk, and reduce emissions. The risk aversion attitude is mathematically modeled through CVaR for selected confidence level. Emissions are included in the objective function as a weighted negative term.

Link Budget of a Ka-Band High Altitude Platform-Based Communication System in the Presence of Dust Storms

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Abstract

High Altitude Platform Stations (HAPS) is an emerging wireless access technology which uses balloons or aircrafts at a specified altitudes ranging between 17 and 50 km to provide wireless services. As any other wireless communication system, a main degrading factor of HAPS propagation channel in desert and semi desert areas is the dust storm attenuation. This attenuation increases with an increasing operational frequency and is prominent in the frequency bands above 10 GHz such as Ku and Ka bands used for HAPS and satellite communications. This paper investigated the effect of dust attenuation on the reliability of the HAPs wireless communication system. Based on a close scrutiny of the existing dust attenuation models, the paper also proposed some modifications to an existing dust attenuation model to comply with the real dust phenomenon. In this work, a platform altitude of 22 km with a minimum elevation angle of 20° was considered. The analysis showed that the dust attenuation degraded the signal to noise ratio by around 20 dB at Ka frequency band. As a result, an appropriate intelligent attenuation mitigation technique was then suggested.

Grid Connected Control of PV System with Reactive Load

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Abstract

Non renewable world energy resources are depleting very rapidly so integration of renewable energy resources into current electrical power systems is inevitable. Larger power plants are more costly because of environmental regulation, lack of right of way and other security issues so utilities are switching toward Distributed Generation. If local power demand increases then generating power locally has many advantages as it helps to reduce power losses and avoid expansion of transmission and distribution system. In kingdom of Saudi Arabia solar photovoltaic is the best candidate among future renewable power resources. Certain advantages like small storage facilities, technology advancement in small scale generation, closer to the load and environmental friendly have made PV systems more attractive. But increasing penetration of photovoltaic in distribution systems has poses many challenges in terms of voltage variations, possible resonance conditions and fluctuations because of reverse power into the grid. In simulations, a PV system is connected with the grid through inverter and a load is connected between grid and inverter. My objective is to control the inverter by checking the status of line from inverter side of the load and then by checking the status from grid side of the load. Incremental conductance plus Integral regulator method is being used as MPPT algorithm while Park transformation is being used for checking the status of the AC side of the inverter. Study shows that load following of inverter gets better if status of line is checked from grid side of the load.

Dust Storm Impact on Satellite Signals based on Probabilistic Particle Size Distributions

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Abstract

Dust storms are a significant cause of wireless channel impairments in desert areas of the world like Saudi Arabia, Sudan, Libya, etc. These impairments are a necessary component in evaluating the optimal link budgets for satellite communication networks. Study of regional surface characteristics gives us the essential information about several variables required in modeling the dust storms such as visibility, average dust particles size, permittivity indices, etc. This paper encompasses physical modeling of dust storms based on the concept of forming layers comprising different visibility levels with reference to different altitudes along with probabilistic dust particles concentrations in each layer. Such strategies help in obtaining accurate impairments estimates, assisting to optimally design the link budgets. Further insight to this phenomenon is justified by simulation results for Visibility, Attenuation and SNR using the mathematical models.

An Efficient Scenario Generation Technique for Short Term Wind Power Production

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Abstract

Power system operators and electricity market participants are facing many challenges due to rapid expansion of wind power. The major issues are due to its probabilistic nature that causes uncertainty in wind power output. An efficient way to handle these uncertainties is by generating scenarios, sampled according to a probability density function associated with the forecasts. Scenarios are important input to a number of problems related to wind energy trading where decision-making is required. In this paper, a new technique is developed to efficiently generate wind power output scenarios which consider expected wind forecast, its variance, and hour-to-hour coupling of wind power output. As the time dependency and ramping rate of wind cannot be neglected, so hour- to hour coupling is an essential part. This technique consists of three main steps initiating, rearranging and eliminating to generate final set of scenarios. It is shown that this technique is simple and very efficient as compared to other scenario generation techniques.

Coordinated Trading of Solar Thermal Energy including EV Charging Strategy

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Abstract

The start up of Electricity Markets created a great opportunity for studying the short- term bidding strategies of generation companies. Energy trading in day-ahead energy market is risky due to the uncertain energy prices, imbalances prices and load demand. Moreover, minimum up/down time constraints of thermal units and stochastic power penetration from Renewable Energy sources (RES) put generation companies at further risk. However, coordinated trading of thermal with RES can mitigate this threat. In this paper, the bidding strategy of solar-thermal coordination is proposed while providing unidirectional Vehicle-to-Grid (V2G) services. The situation of utility that have solar and thermal generators and use EVs for V2G services provision is investigated with the objective to maximize total expected profit. The problem is devised as a mixed integer stochastic linear programming (MIP) with four random/stochastic parameters. A realistic case is developed for comparing uncoordinated with coordinated thermal bidding strategies and satisfactory results showing coordination benefits are obtained.

Optimal Coordination of Directional Overcurrent Relays using Intelligent Technique

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Abstract

In this paper, directional coordination of over current relays (DOCR) is treated using Genetic Algorithm (GA). Genetic algorithm gained a lot of interest due to its easy and simple implementation and its robust nature. The coordination problem of relays is highly constrained optimization problem and previously had been solved using the linear programming (LP) techniques. Modification to the original genetic algorithm is performed to deal with the constraint in the optimization problem. Two networks problems are presented in this paper, and the results obtained are compared with the PSO of the previous published literature to demonstrate the effectiveness of the proposed method. Finally, the results obtained from the GA program are verified on a commercial software etap 7.0. The results obtained are satisfactory.

Wind Thermal Generation Scheduling with Fuzzy Genetic Optimization

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Abstract

This paper presents a fuzzy genetic scheduling optimization for solving the wind-thermal scheduling problem. Wind energy is being considered in this formulation to minimize the total thermal fuel cost. While performing the generation scheduling in a conventional manner, there are always errors associated with different parameters like load demand, spinning reserves and especially the wind power forecast. In order to take into account the uncertainties associated with them, fuzzy sets notations are used. The proposed method is effectively applied to a power system with 10 thermal units and a wind plant. The results show the effectiveness of the fuzzy genetic method and results in less costly solution.

Complexity-Aware-NMSE "CAN" Metric for Dimension Estimation of Memory Polynomial Based Power Amplifiers Behavioral Models

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Abstract

Wireless communications are continuously in need of wider bandwidth signals especially for the emerging applications that target very high data rates. The access techniques used to enable such high data rates within the limited frequency spectrum often result in wideband signals having high peak to average power ratio. This sets stringent requirements on the power amplifiers of the radio frequency transmitter. Indeed, the amplifiers need to operate linearly while being power efficient. These are two antagonist requirements for amplifiers handling amplitude modulated signals. The best trade-off is achieved by operating the power amplifier in nonlinear mode for power efficiency and then restoring its linearity by means of linearization circuitry. In this context, it is important to understand, model and compensate for the nonlinear distortions generated by the power amplifiers. Behavioral modeling is an important step in examining the performance of the power amplifier incorporated in the radio frequency front-end system and also the performance of the wireless transmitter in general. This paper focuses on an approach suitable for the selection of the model dimensions in memory polynomial based power amplifiers' behavioral models. It is based on a hybrid criterion that takes into account the model accuracy and its complexity. Experimental validation were carried on two Doherty amplifiers using LDMOS and GaN transistors and driven by 40MHz wide WCDMA signals. The results demonstrate the advantages of proposed technique as it reduces the model dimension by at least 60% without compromising its accuracy.

Adaptive Equalization Based on Hybrid Particle Swarm Optimization Technique

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Abstract

Adaptive equalization made it possible for digital data transmission over radio and telephone channels, as it mitigates the distortions caused by these channels. Different algorithms have been used in adaptive equalization, e. g., the least mean square (LMS) and the recursive least square (RLS) algorithms. Recently, particle swarm optimization (PSO) technique was introduced and turned out to be very effective in handling problems having non linear behaviour. Different versions of the PSO algorithm were proposed, to name a few, the PSO using linearly time decreasing inertia weight (PSO-W) and the PSO using constant constriction factor (PSO-CCF). However, these algorithms still suffer the problem of stagnation and can become useless in a situation when the solution hits a local minimum. To address this issue, a new PSO-based algorithm is proposed, the hybrid PSO (HPSO). The HPSO includes re-randomization of particles to improve the search capacity of the swarm; it introduces more socialized behaviour among particles, so that there is less chance of getting trap in to some local minima; and finally adapts the inertia weight assignment to the particles. This hybrid algorithm secured the minimum steady state error as compared to all previously used PSO algorithms as well as the LMS and RLS algorithms in non-linear and linear channels. Moreover, great improvements in BER and convergence rate are obtained using this newly developed algorithm. Finally, extensive simulation results are conducted to confirm the consistency in performance of the HPSO algorithm in different scenarios.

Application of a PSO algorithm in adaptive equalization using adaptive inertia weights

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Abstract

High-speed data transmission over dispersive channels adds different kind of impairments to the transmitted signal including inter-symbol interference. To mitigate such impairments adaptive equalization (AE) is used. Different algorithms like the least mean square (LMS), the recursive least square (RLS) and the steepest descent algorithms have been used extensively in AE. Recently, particle swarm optimization (PSO) techniques have shown great improvements over gradient and least-squares-based algorithms in an adaptive equalization scenario. Different versions of the PSO algorithm were proposed, for example, the PSO using a linearly time decreasing inertia weight (PSO-W) and the PSO using a constant constriction factor (PSO-CCF), just to name a few. Convergence rate and steady state error are always two conflicting parameters. The PSO-CCF and the PSO-W algorithms are known to have fast convergence behaviour and a lower steady-state error, respectively. Exploiting both of these advantages, in this work a newly developed PSO-based algorithm is presented. This algorithm continuously adapts the inertia weight resulting in the PSO-AW algorithm. A great improvement in performance is obtained using this technique over the above-mentioned algorithms and others of similar computational complexity. Extensive simulation results carried out over linear and non-linear channels showed the better performance brought about this newly implemented algorithm.

Novel Particle Swarm Optimization for FIR Filter Design

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Abstract

This paper illustrates an optimal design of linear-phase digital high pass finite impulse response (FIR) filter with a novel Particle Swarm Optimization (NPSO) method. Conventional method such as windows method and frequency method have been proved to be robust and efficient with linear phase filter design, but these methods always get suboptimal solutions. Besides, when problems have more coefficients or they are non-linear, conventional PSO lose its magic. Evolutionary Methods is introduced to solve these problems. Particle Swarm Optimization (PSO) has been widely used for optimization problem and shown to be very useful, but as more coefficients need to be optimized, conventional PSO will always failed to find the optimal solution or be trapped into local minima. NPSO is an improved PSO with a novel definition of velocity vector and update algorithm, it has been proved to improve the results in many cases. In this paper, we will use NPSO to get the optimal results and compare with those obtained from other methods and also combine them together to get better solutions.

An Edge Detection Algorithm for Identifying Vacant Spaces in Parking Areas

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Abstract

With the rapid expansion of major cities in the Kingdom of Saudi Arabia, the tremendous increase in number of vehicles, and the construction of huge buildings and parking areas, there is a need to develop a smart parking system to assist drivers finding the nearest available parking spots. Such systems have witnessed substantial research efforts in developed countries. A previous study has shown that traffic due to car park searching in downtown of major cities can account for 15-45% of the total traffic. There are mainly four categories of car parking management system: counter-based, wired-sensor-based, wireless-sensor-based, and image-based. In this study, we propose to investigate, develop, implement, and test an image-based system for the detection of vacant spaces in a parking area. Following an initial edge detection stage, we propose to use edge and closed contour densities, at every car parking spot, to identify whether a car is present or not. Information about the location of the closest vacant parking space will be delivered to the driver through side display boards or right to his mobile.
Keywords- Smart Parking, Image Processing, Edge Detection

Nanoscale Plasmonic Interferometry

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Abstract

Interferometry is one very highly sensitive method of exploiting the phase changes in light for detecting changes in refractive index. .In an interferometer the two interfering light waves have same intensity but with a difference in phase. This phase change ϕ brought about distance travelled by the second light and giving a change in amplitude of the resultant wave. Surface Plasmons interfere on similar lines and the phase change in the Interacting SPs is can be brought about by the distance travelled by SP and the effective refractive index which each SP experiences and each wavelength interferes differently. This paper investigates the sensitivity of Surface Plasmon Interferometers for measuring the changes in refractive index.

Programmable Radio Frequency (RF) Feed Network: Design and Architecture

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Abstract

The design of a Wide-Band programmable RF feed network is proposed. The design architecture is composed of four main stages, switching, phase shifting, amplification/attenuation and control. The proposed feed network is designed to cover a wide band from 2.5 to 6 GHz over two separate paths, one covers from 2.5 to 3 GHz and the other covers from 3 to 6 GHz. Digitally controlled phase shifters are used to control the phase. A microcontroller unit is used to provide the required signals for all the feed networks stages. Digitally controlled variable gain amplifiers are used to set the appropriate amplitude to the signal in both paths. A two port board that is simulated and fabricated on an FR-4 substrate with thickness of 0.8mm. The amplitude and phase resolutions were 0.55 dB and 5.77^{o}, respectively. This work can be used in military applications (Radar Systems) or civil use (Telecommunications Operators).

A Novel Method of Parameter Identification for PV panel and Its Assessment Using Different PV Technologies

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Abstract

Electrical characteristics of a photovoltaic (PV) panel can be represented by an equivalent electric circuit model. The major challenge in the implementation of this model lies in determination of the model parameters. The exact values of these parameters are required to regenerate the output characteristics of PV panel accurately. In existed parameter estimation methods; some methods are inaccurate because of the approximation they made in the estimation process and other require experimental data that is usually not provided by the manufacturer. In this study, model parameters are identified using the efficient stochastic optimization technique. Estimation problem is converted into optimization problem where Differential Evolution (DE) as an efficient optimizing technique is employed to estimate the model parameters at standard test condition (STC) (1000 W/m^2 and 25^oC) using only the data provided by the manufacturer. The identified parameters values are confirmed by comparing the determined I-V curves with the experimental curves given in the data sheet. It is found that the suggested approach presents better results under all the operating conditions. The effectiveness of the proposed method is analyzed by estimating the parameters of two PV panels of different technologies (crystalline and thin film). Result and analysis shows that the proposed method can simulate the output characteristics of both the technologies efficiently.

Mathematical Modeling of A Generalized PV Array

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Abstract

The output characteristics of a photovoltaic (PV) array are highly non-linear. An accurate and efficient PV array model is required to study and analyse the operation of photovoltaic system in the changing environmental condition. Taking into account the significance of this subject, in this paper a generalized PV array model simulator is proposed and developed in the MATLAB/Simulink software package in the form of masked block. The simulator is designed based on the five parameters equivalent electric circuit model. This model is selected because of its better performance and acceptable computational time as compare to other circuit based models. The designed simulator can generate the output characteristics of a PV array precisely at different operating conditions and it is flexible enough to simulate any number of PV panels connected in series and parallel. The robustness of the proposed simulator is demonstrated under the partial shaded conditions. Additionally, the performance of the developed simulator is verified by interfacing it with the actual power electronics converter and maximum power point tracking (MPPT) controller. The proposed work will facilitate the power system design engineers to assess the behaviour of the newly developed controllers and performance of the overall power system prior to any practical implementation.

A Novel Two-Threshold Cooperative Spectrum Sensing Algorithm using Swarm Intelligence

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Abstract

In recent years, we have witnessed a rapid growth in wireless communications, especially in providing quality multimedia services, and as a result, there is ever growing demand for radio spectrum. The present static frequency allocation cannot accommodate this demand as most of the spectrum is occupied by licensed users and is used inefficiently. Cognitive Radio (CR) has emerged as an exciting and effective technology to solve the inefficiency of spectrum usage by opportunistically accessing the under-utilized frequency bands without interfering with the licensed users. However, individual cognitive radios may not be able to reliably detect the presence of a primary user due to environmental effects such as channel fading and/or shadowing, and noise. Cooperative spectrum sensing is used in order to improve sensing reliability. In this paper, we propose a Hybrid PSO-OR (Particle Swarm Optimization and OR) algorithm which uses a double threshold energy detector to perform spectrum sensing. The fusion centre, in the cognitive radio network, collects local decisions as well as energy values from secondary users. PSO is used at the fusion centre to optimize the decision from "fuzzy" secondary users. A final collective decision is made based on local decisions and observation values. This way, double thresholds will help in reducing the communication overhead over the reporting channel compared to conventional data fusion techniques with a negligible loss in performance. Our results show that the proposed Hybrid PSO-OR algorithm outperforms the Hybrid EGC-OR algorithm. We provide the expressions for the probabilities of detection and false alarm, and the average number of bits over the reporting channel.

A Novel No-Reference Image Quality Metric using Neural Networks

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Abstract

To assess the quality of distorted images/videos, human observers don't require the original image as a reference. But to formulate the objective image quality measure especially in absence of the original image makes the task more challenging. This research aims at developing an algorithm for predicting image quality distorted by JPEG compression, JPEG2000 compression, blurred and noise without using any reference image. In the proposed approach, we extract a set of characterizing features which represent the different types of distortions in the image. Two groups of features are obtained which form the basis for objective quality prediction. After the features are extracted, an artificial neural network (ANN) is used as a regressor to predict subjective quality. The ANN is trained with the feature sets as input along with their corresponding subjective scores (DMOS). The trained network is then tested on the standard LIVE database using the correlation coefficient, rank order correlation coefficient, root mean square error, mean absolute error and outlier ratio as measures of performance. The proposed approach is applied for all the four types of distortions images namely, JPEG and JPEG2000 compression, blurred and white noise images. The network is trained and tested for each type of distorted images individually, then finally across all types of distortions. The predicted scores from the model showed significant correlation between the predicted scores and the objective scores. The proposed quality measure is shown to outperform the traditional measure proposed by Bovik and his team and other metrics introduced in the literature.

Combining Distributed Cooperation with Centralized Spectrum Sensing: A Game Theoretic Approach

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Abstract

In cognitive radio networks (CRNs), cooperative detection is realized through either *centralized* sensing or *distributed* sensing. Centralized spectrum sensing relies on fusion center for decision making which sometimes does not exist (e.g. ad-hoc networks) or is simply not accessible by all cognitive radios (CRs). On the other hand, distributed sensing requires large control bandwidth for excessive message exchange and increased sensing time for the distributed algorithm to converge. Thus, the key challenge in cooperative spectrum sensing for CRNs is to find an optimum amalgam of centralized and distributed approaches with an aim to achieve maximum *cooperative gain* with minimum *cooperation overhead*. To address this challenge, we propose to use game theoretical model for developing a cooperation strategy based on distributed *coalition formation* followed by centralized *coalition sensing*. We evaluate average throughput per CR as the targeted *cooperative gain* while considering the time spent in collecting local sensing results to be the incurred *cooperation cost*. We consider maximizing the individual gains (*selfish*) and group gains (*altruistic*) while defining the *coalition formation* rules and compare them in terms of achievable average throughput per CR under varying network parameters. Results show that altruistic coalition formation offers higher average throughput per CR when compared with selfish and non-cooperative solutions and it converges to grand coalition when all the CRs in the network received very low SNR. However, for large values of sensing reporting time, the large coalition size resulting from altruistic approach degrades the achievable cooperative gain and selfish solution matches the altruistic solution.

Automatic License Plates Recognition in Saudi Arabia

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Abstract

License plates and traffic signs detection and recognition have a number of different applications relevant for transportation systems, such as traffic monitoring, detection of stolen vehicles, driver navigation support or any statistical research. A number of methods have been proposed, but only for particular cases and working under constraints (e.g. known text direction or high resolution). The Problem which the project solved at the end that is how to detect the license plates in Saudi Arabia , after that how to recognize the numbers on the plates automatically . I developed automatic license plates detection and I work to implement a new algorithm OCR to recognize all types of plates in Saudi Arabia. I installed the project and tried it and I get good results for detection plates.

Mitigation of Power Surges in a 500kV Tapped Transmission Network for Protecting Generating Sets – A Case Study

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Abstract

Transmission networks are highly critical and costly constituents of electrical power system. Normally the plan of transmission system covers a span of 25-30 years. But there are certain situations that could lead to significant and extremely necessary amendments that could lead to a number of problems. This paper deals with a similar issue. This work has been developed on the basis of a case study that relates to a real time transmission network affected by the introduction of a new tap. This tap gave rise to a couple of problems which are power surge and circuit breaker synchronization failure. The objective of this paper is to perform necessary calculations to estimate the value of power surge and also to devise appropriate and practical solutions for handling the system with minimum disturbance and outage probability.

Penalty Function Method for Economic Load Dispatch with stochastic Wind Power as Constraint

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Abstract

In my paper, an economic load dispatch model is developed for both wind turbines and thermal generators. Since the wind power has random nature, it is considered as a constraint in this economic dispatch model. This optimization problem is solved to obtain optimal power ouputs of thermal generators, while taking into account of given constraints. All these optimal outputs and available wind power must satisfy the load generation balance of the power system. The model also includes certain other constraints. These constraints are minimum and maximum limits of generator power outputs. Due to random nature of wind speed, its variations can be best described by Weibull distribution and a general model for a wind turbine is considered to relate wind power with this wind speed which is used for probablistic analysis of wind power. The closed form solution of this model is not possible due to the inequality constraints and this problem is solved by using penalty function method. These inequality constraints are handled by using penalty functions which are augmented in the economic dispatch model. This augmented objective function is solved using penalty function optimization algorithm to obtain optimal solution.

Daily scheduling of producing electric power from hybrid system contains Wind, Pump Storage Hydro facilities and two thermal units

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Abstract

In this work will presenting an approach to optimize the daily scheduling of producing electric power by an independent power producer which owns a hybrid system contains Wind-Pump Storage Hydro (WPSH) facilities and two thermal units. In order to describe and optimize a unit commitment schedule depending on forecasted wind energy to this hybrid system a mathematical equation has been developed also to maximize the owner profit, and the solution has been done by developing a Linear Program on MAPLE software.

Performance Evaluation of a Microgrid containing inertial and electronically coupled sources with storage technology

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Abstract

In this manuscript, we developed a detailed dynamic model of a non-autonomous microgrid which has distributed generation from Photovoltaic(PV), Fuel cell (FC) and conventional sources (a micro alternator driven by a prime mover), along with their power electronic circuits and the associated filters. The performance of such a microgrid has been investigated through MATLAB/SIMULINK simulations. Battery storage along with VSC (Voltage Source Converter) has been used as control device for the above microgrid. Simulations are performed to assess the stability of the microgrid under different disturbance conditions. P-Q decoupled controller is being employed for the VSC in order to enhance the stability. The design of the controller parameters is considered an optimization problem and they are optimized by employing a global intelligent search technique called Biogeography based optimization (BBO). The effectiveness of the controller in mitigating the abnormal conditions is being assessed by simulating different disturbance conditions on the microgrid.

Isolation Enhancement for 4G handset Antenna Systems

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Abstract

The performance of a Multiple-Input-Multiple-Output (MIMO) system relies on multiple channels that are established between the multiple radiating elements of the transmitter and the receiver systems. Multiple radiators, coupled with each other, act as a single radiator that cannot establish multiple channels. This means that the radiators in the transmitter and the receiver antenna systems should be decoupled so that their signals are different and independent from each other and hence the correlation between the signals should very low. This requirement implies that the radiating elements in MIMO antenna systems should be very well isolated.

In this work, isolation enhancement structures will be designed for printed MIMO antenna systems. The proposed isolation structures will be based on the defected ground structure (DGS) and capacitively loaded loops (CLLs) based metamaterial. The isolation structures will be applied to a 4-shaped, dual-band and dual-element printed MIMO antenna system. This antenna system resonates at the low band at approximately 850MHz and a high band at approximately 2.7GHz. This work has very practical uses in 4G mobile terminal design that telecommunication manufacturers in the Kingdom currently supports.

Scattering from Circular Conducting and Dielectric Cylinders

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Abstract

In this paper, scattering of plane wave by circular conducting and dielectric cylinders of infinite length is investigated using boundary-value method. Scattering pattern and back-scattering cross-section due to an E-polarized plane wave is computed. The backscattering echo width is calculated for different and for same radii for both cylinders. To validate the results of our formulation, we model our problem to one cylinder to be either conducting or dielectric one. It has been observed that the results are in good agreement with the available data taking each case independently .

Differential Evolution based Intelligent Control for Speed Regulation of a PMDC Motor

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Abstract

Differential Evolution (DE) is an evolutionary algorithm (EA) known for its simplicity, robustness and performance. Compared to other EAs, DE has shown better performance according to recent research. In this paper a DE algorithm is designed for controller optimization of a PMDC motor speed regulation system. Presenting a comprehensive description of the plant, architecture is designed for automatic speed regulation. Then the DE algorithm is applied on the system to optimize the controller parameters. Performance of the optimal controller is studied with simulations and performance and robustness of the DE algorithm has been analyzed.

Robust Stabilizing Controller Design for a UAV Helicopter Disturbed with Wind Gust

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Abstract

In this paper the problem of H_2 and H_∞dynamic controller design using output feedback is considered for an unmanned aerial vehicle(UAV) helicopter system. The controller design approach is based on solving the H_2 and H_∞ arithmetic Riccati equation (ARE). The helicopter is in hovering flight and wind gust is considered to be acting on it as the main source of disturbance. The objective is to design a robust stabilizing controller which means that it rejects the effect of the wind gust disturbance and keep the helicopter stable in the hovering condition. The performance of the controllers will be tested with simulations and results will be analyzed.

CSRR Loaded MIMO Antenna System for 802.11ac WLAN Application

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Abstract

A compact 8-element MIMO antenna system which conforms to the new 802.11ac standards is designed for WLAN applications. The antenna operates in the 5 GHz band. The elements of the MIMO antenna system are patch antennas loaded with the CSRR for antenna miniaturization. The overall size of the MIMO antenna system is 100 x 50 x 0.8 mm3. The measurement results of the fabricated antenna are found to be in agreement with the simulation results of the design. The measurements show that the proposed MIMO antenna has a minimum bandwidth of 80 MHz and a minimum isolation of 10.95 dB between its antenna elements. The maximum gain for a single operating element of the proposed antenna is -0.16 dBi. The antenna can be easily integrated with the communication devices designed to operate in 5 GHz WLAN band.

Performance Evaluation of a MIMO Antenna System

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Abstract

The improvement in the diversity gain of a multiple-input-multiple-output (MIMO) communication system is highly dependent on the performance of its MIMO antenna. Therefore, it is vital to evaluate the performance of a MIMO antenna system. Conventional antenna performance metrics are no longer sufficient to describe and predict the performance of a MIMO antenna system in a real wireless environment. This paper explains all the important parameters which are necessary for the proper evaluation of a MIMO antenna system. A 2-element MIMO antenna system made up of patch antennas as its elements is used as an example in this paper to explain all of the MIMO antenna performance metrics. The TARC, correlation coefficient, MEG and channel capacity of the MIMO antenna system in an urban environment are calculated to show how a MIMO antenna is evaluated against these performance metrics. All these parameters are extremely important to note for proper antenna evaluation for telecom operators in the Kingdom.

Mobile-Based Location Estimation Using Single Base Station

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Abstract

The location of subscribers has received huge attention in application for the wireless services. It is well-known that the satellite-based positioning system (GPS- Global Positioning System) is a sufficient and reliable technique for coordinating services. Many techniques using base-stations depend on some wireless parameters such as signal strength, reflection factors, ducting are now being deployed for estimating the locations of the subscribers. This paper discusses some scenarios of wireless mobile location estimation by utilizing only single base-station (BS). A site of Al-Dhahran city in KSA will form the base map for the proposed scenarios and proper solutions will be suggested accordingly. The simulation results performance of the approaches used will be compared with the FCC standard readings.

A Wireless Tracking System of a Moving Object in 2D

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Abstract

In this project, a system was developed to wirelessly track the trajectory of a moving vehicle (Radio Controlled – R/C Car) in real-time in 2D for outdoor and indoor applications. The tracking was performed with the help of an inertial measurement unit (IMU), ZigBee transceivers and a controlling PC. The IMU was used to obtain the accelerations and the angular velocities along each axis of the rectangular coordinate system. The Arduino microcontroller on board the IMU was programmed to extract the data, which was relayed to the PC using ZigBee transceivers. The calibration, noise cancellation using Kalman filtering and all necessary physical and mathematical calculations to obtain the displacement were accomplished using MATLAB. Finally, the plots of the trajectories were generated in real-time and displayed on a graphical user interface. The accuracy of the system was also tested by performing various case studies. These involved indoor and outdoor tests, where the trajectories were superimposed on known paths followed by error analysis. It was found out that there is a scale factor dependent on the environment and inversely proportional to the object velocity. Also, the error in the results becomes larger in indoor tracking and it propagates with time. The developed system can be used on any moving platform and can be utilized by civil service agencies, such as the fire department or the police department.

Cooperative Spectrum Sensing Based on Improved Evidence Theory

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Abstract

Cognitive radio provides an attractive solution to resolve the perceived bandwidth scarcity versus under-utilization dilemma. Spectrum sensing is used to locate the unoccupied frequency bands. In presence of severe shadowing and fading, a single cognitive radio may generate erroneous results and may cause increase in interference. Cooperative cognitive radio networking can help to overcome such scenario. The results generated by cognitive radio devices have great uncertainty because of the channel conditions. In this paper data fusion of the multiple cognitive radios is performed using the Dempster Shafer evidence theory. Before merging the data two different schemes are used to degrade the knowledge of unreliable cognitive radio. In addition few enhanced Dempster Shafer evidence rules are also applied for data combination. Finally a proposition is made to one of the scheme for data merging which shows good performance when compared to the previous technique.

A HYBRID EGC-OR DETECTION ALGORITHM FOR COOPERATVIE SPECTRUM SENSING

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Abstract

In this paper, we propose a new hybrid technique for cooperative spectrum sensing (CSS) in cognitive radio oriented wireless networks (CROWN) in which we combine hard and soft decisions. A two-threshold energy detector is used at each CR to classify it as either a hard-decision CR (HDCR) or a soft-decision CR (SDCR). While the HDCRs transmit a binary decision to the fusion center, the SDCRs only transmit a quantized version of the energy. We show that the proposed technique can drastically reduce the number of feedback bits at the cost of a negligible loss in performance compared to equal gain combining (EGC). We derive the closed form expressions for the probability of detection (Q_d) and the probability of false alarm (Q_f). Furthermore, we also derive a closed form expression for the average savings in the total number of feedback bits. We validate our derivations using a number of simulations under AWGN and Rayleigh fading environments.

A Survey of Wavelet Transform based Spectrum Sensing Techniques

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Abstract

In this paper, a thorough literature survey on the use of the wavelet transform in spectrum sensing is presented. The wavelet transform has found many uses in other research areas, e.g., image processing, seismic signal processing, etc., but the use of wavelet transform in the context of cognitive radio is new. The research methodology adopted is to extract the published papers from the popular research papers' databases, mainly IEEE Xplore, which addresses the use of wavelet-transform for the purpose of spectrum sensing, and highlight the proposed approaches with their pros and cons. The system models and experimental setups for the particular papers will be described respectively. It is expected that such type of survey would serve as a comprehensive guide for a student/researcher who wish to start fresh in the area of spectrum sensing using wavelets.

Design and Implementation of a Microcontroller Based Multifunction Relay

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Abstract

Electrical power system protection plays a major role in power system operation and control. Protection is essential for both human and equipment safety and for the system reliability. The main component in power system protection systems is the relay. The major task of relays arises in detecting the abnormal operating conditions of power systems such as overloading, faults, unbalancing,…etc. Traditionally, electromechanical relays were widely used for protection purposes. Recently, digital relays which make use of micro-controllers are evolving abruptly and replace the traditional electromechanical ones due to their accuracy, flexibility, and multi-purpose function they can achieve.

In this work, a cost-effective multi-function micro-controller based protective relay has been designed and implemented. Initially, a MATLAB codes were developed to simulate a time delay overcurrent and negative sequence relays. The four sampling method is employed to estimate the current rms value. The main function of the designed relay is to detect the abnormal conditions due to overloading, fault, and unbalance operation of a power system in addition to the metering function. A prototype of the proposed design has been developed and experimentally tested with impressive success. The developed prototype contains current transformers, conditioning circuits, A/D converters, and a microcontroller chip.

POWER PLANTS AND THE EFFECT ON ENVIRONMENT AND HEALTH

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Abstract

This report will discuss several types of the power plants available on stream. It elaborates in depth by presenting the advantages and disadvantages for each kind. Moreover, it evaluates each case in different prospective. The main concerns focused in this research are on health and safety matters related to the environment, the capability of the energy to be renewal, the flexibility of using each type on different conditions, and the cost of construction and the producing power.

Implementation of a Sensor-Based Smart Parking System in Saudi Arabia

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Abstract

Rapid urban development in Saudi Arabia has resulted in the overcrowding of vehicles causing a shortage in the number of parking spots available. To deal with this problem, multi-story parking complexes and huge parking lots have been built everywhere. Usually, these places are more than 95% full during peak times and finding a parking spot in these places becomes a tiring and often time-wasting trial and error process. The aim of this project was to eliminate the guesswork from the process of parking a car by designing and building a system that can guide the user to an available spot. Technically, such a system could either be sensor based or camera based; this project focuses on the design of a low cost, sensor based system. The design utilizes various sensors to detect the availability of a parking spot. An Arduino micro-controller is used to process the sensor data, which is then transmitted to a remote LCD/LED Display over Wi-Fi where available parking spaces can be graphically presented to the user. Multiple sensors types will be used and their working compared. This type of project has never been implemented in the Kingdom and this project represents the first attempt ever made in Saudi Arabia. The initial testing is performed at the parking spaces and garages of King Fahd University of Petroleum and Minerals (K.F.U.P.M.).

Analyzing IEEE 802.11 DCF for Finite User Finite Buffer Systems using Tagged User Analysis

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Abstract

Performance of IEEE 802.11 DCF (distributed coordination function) has been widely studied mostly using Markov chains. Markov analysis becomes practically intractable for systems with finite users/stations (STAs) each having a finite buffer capacity. In this paper we have used an approximate technique, Tagged User Analysis (TUA), for the analysis of QoS parameters like system throughput, wait delay, response time, packet blocking probability and average queue size. Simulation results show that TUA can accurately be used for the analysis of IEEE 802.11 DCF.

A Novel Low-Complexity Relaying Protocol for Decode-And-Forward Relay Systems with Interference

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Abstract

In this study, we propose and evaluate the outage performance of a new low-complexity relay selection protocol for dual-hop decode-and-forward (DF) relay systems in the presence of interference at the relay and destination nodes. The protocol is mainly based on the switch-and-examine diversity combining (SEC) and SEC with post-selection (SECps) techniques in which a relay out of multiple relays is selected to forward the source signal to destination. The selection process is performed such that the signal-to-noise ratio (SNR) of the second hop of the selected relay satisfies a predetermined switching threshold. Such a relay that satisfies this threshold is chosen to forward the source signal to destination. In the analysis, we first derive the statistics of both the SNR at the output of the relay selection scheme and the end-to-end (e2e) signal-to-interference plus noise ratio (SINR) assuming Rayleigh fading channels. The derived statistics along with the statistics of the first hop channels of relays and the direct link are then used to derive the outage probability of the system. We assume that maximal-ratio combining (MRC) is used at the destination to combine the signal from the selected relay with that on the direct link. Monte-Carlo simulations and some numerical results are provided to illustrate the validity of the derived analytical results and to show the effect of interference and other parameters on the system performance. Main results illustrate the significant reduction in the required number of channel estimations and hence, the system complexity our proposed relay selection scheme can achieve compared to the existed relaying protocols. Furthermore, findings show that the maximum gain in system performance due to adding more relays happens in the region where the value of switching threshold is comparable to the average SNR value. Finally, results illustrate the gain achieved in system performance, especially, at the range of SNR values that are comparable to the switching threshold when the SECps selection scheme is used compared to the conventional SEC relaying.

Optimal Pilot Symbols Distribution for Narrowband Interference Mitigation in UWB Systems Based on Compressive Sensing

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Abstract

Ultra wideband (UWB) technology is promising a cutting edge in delivering high data rate for short range wireless communication systems. Because of their large bandwidth, UWB signals may encounter some problems especially with high sampling rate required at the receiver side. Moreover, coherence existence with other narrowband systems is a major concern which needs to be avoided through a proper mechanism. Since narrowband interference (NBI) signals have sparse representation in the discrete cosine transform (DCT) domain, they can be estimated and their effect can be suppressed using Compressive Sensing (CS). CS also has the ability to reduce the high sampling rate. In this paper, a trained UWB system is investigated in the presence of a strong NBI. For training, three pilot groups symbol are used to estimate the NBI signal subspace, UWB signal subspace, and provide information about the channel. The paper investigates the optimum pilot symbols distribution that optimizes the bit error rate (BER). Additionally, the influence of each pilot group symbols is also studied under the effect of the same interference.

Analog Computational Unit for Low Power Applications

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Abstract

Log-antilog based versatile building block for implementing computational functions such as four-quadrant multiplier, squarer, divider, inverse and cube-law in analog domain is proposed and simulated in 0.35μm 2p4m n-well CMOS process using Tanner tool. The proposed block features current-mode operation and consumes around 13.184μW from ±0.75 V power supply. The linearity error is less than 4.1% and the -3 dB bandwidth of the overall circuit has been observed to over 700 kHz. The total harmonic distortion (THD) is found to be less than 2.25%. Simulation results of all proposed functions are given to verify the theoretical analysis.

Realization of 96 dB-Linear Exponential Current Generator

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Abstract

A novel exponential approximation function is proposed to achieve a large dynamic output range and a maximum input range while keeping the linearity error less than ±0.5dB. The simulation results with the 0.35µ CMOS process technology confirms that the performance of our proposed function is better than previously reported approximation functions. A nearly 96dB dynamic output range is obtained with the linearity error less than ±0.5dB over a maximum input range (-5.7 to 5.7).

Dual-band Jamming System for Wireless Communication Applications

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Abstract

The purpose of this project is to design, implement, and test a cellular phone radio frequency (RF) jamming system. This system consists of a noise signal generator circuit, an RF front-end that amplifies the noise signal and up-converts it to the targeted communication frequency bands, and two antennas to transmit the jamming signal in the 900MHz and 1800 MHz bands. The project consists of three parts: simulation of the design, hardware implementation, and testing the jammer on actually operating cellular phones using two different telecommunication operators in the kingdom. The simulation was done using Advanced Design System (ADS) software, the simulation model was based on the characteristics of the components obtained from the datasheets supplied by the vendor as well as S2P files built using measured S-parameters of the components. The hardware implementation was done using off-the-shelf components. The noise signal generated had a bandwidth of about 30MHz in both the 900 MHz and 1800MHz bands. The implemented design was experimentally tested. Measured results shows that the designed system is able to jam both 2G and 3G signals inside building 59 with a distance of 2-3 meters from the antenna.

On the Sizing of the Nested Look-up Table Power Amplifiers Behavioral Model for LTE Applications

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Abstract

Linear power amplifiers (PAs) are required for radiofrequency (RF) transmitters to avoid any distortion of the signal that might be caused during the amplification process. However, high efficiency of these amplifiers is obtained in their nonlinear region. Thus, a tradeoff between the linearity and the efficiency is needed. Accordingly, modeling PAs nonlinearities is very critical in order to predict the system's linearity performance. Many structures have been proposed to model the behavior of nonlinear RF PAs. In this paper, the focus will be on one of the newest structures proposed for modeling PAs which is the nested look-up table (NLUT) model. This NLUT model is constructed in a table based on the measured input samples of the PA and the corresponding output samples. Doing so will enable the model to store the instantaneous gains of the nonlinear PA. After this model identification stage, the output can be predicted for any input signal. Several issues and difficulties related to this new model are addressed in this paper. These include sizing of LUT, quantization levels and the improvement of the overall performance in terms of normalized mean squared error (NMSE). The model was validated using experimental measurement data for a base station power amplifier driven by multi-carrier LTE signal. Mainly, it was found that increasing the size of LUT does not necessary result in better performance. The conclusions shed the light on one of the most severe drawbacks of the nested LUT model which was misleadingly thought to be its size requirements.

Real-Time Detection and Classification Scheme for Voltage Events Based on Wavelet Transform

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Abstract

This paper presents a new technique for real-time detection and classification of voltage events based on wavelet multi-resolution analysis (MRA). In the proposed technique the finest detail level has been utilized to detect the start time, the end time and the duration of the voltage events while the coarsest approximation level has been utilized to classify the voltage event type. The proposed method has been implemented in a laboratory setup using LabVIEW platform. Different voltage events such as sag, swell, and interruption have been applied to examine the effectiveness of the proposed method. The experimental results demonstrate the superiority, accuracy, and robustness of the proposed method in detection the details of the voltage events as well as the event type classification. This makes the proposed approach more suitable for online applications.

Optimal Estimation of Harmonics in Power System Using Intelligent Techniques

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Abstract

This paper presents a new algorithm for harmonic estimation in power systems. It utilizes separable least squares (SLS) technique to estimate the magnitude and phase angle of the harmonics by analyzing the waveform. As well as hybrid techniques have been utilized in this paper to estimate harmonics, real coded genetic algorithm (RCGA) and particle swarm optimization (PSO) utilized to estimate the phase of the harmonics, alongside a least square (LS) method used to estimate harmonics amplitude. The three techniques are analyzed and the results are compared in terms of percentage of error and processing time. The results have been shown to accurately estimate harmonics. Furthermore, the results showed the suitability of the proposed techniques for online harmonics estimation.

Minimization of Transmission Power Loss by Intelligently Tuned Interline Power Flow Controllers (IPFC)

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Abstract

Comparison of various intelligent search algorithms in tuning the Interline Power Flow Controller (IPFC) to diminish the transmission losses in a power system network has been investigated in this manuscript. The IPFC belongs to the family of series compensating FACTs devices and has the ability of managing the power flow among multiline transmission systems. It has a voltage source converter (VSC), which can be adjusted to regulate the power flow in a corresponding line.
In this work, a study of the capability of IPFC to reduce the transmission losses is established. First, the steady-state model of an electrical power system along with IPFC is developed using MATLAB/SIMULINK. Next, the selection of parameters of the IPFC controller is considered as an optimization problem and the parameters are tuned by applying three intelligent search techniques: 1) Differential Evolution (DE), 2) Artificial Bee Colony (ABC), and 3) Particle Swarm Optimization (PSO). Finally, the effectiveness of the device in diminishing the line losses is demonstrated.

A New Power Flow Control Scheme Using Interline Power Flow Controllers (IPFC)

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Abstract

The Flexible AC Transmission System (FACTS) devices are low-environmental impact, cost effective and long term proven solutions to transmission line difficulties. Interline Power Flow Controller (IPFC) is a novel FACTS device with an exceptional ability of power flow controlling among multiline transmission system. This paper attempts to diminish the power deviation in a particular transmission line utilizing IPFC by adjusting angles and magnitudes of the series voltages source converters representing IPFC. To the best of our knowledge, there has been no clear study till now proposes employing the IPFC to this application. A case-study is presented at the end of this investigation with the aim of simulating the ability of this device to maintain the power flow in a transmission line unchanged. The Differential Evolution (DE) algorithm is employed to search for the optimal settings of the IPFC since it is a powerful tool, simple and fast to converge. The results show the effectiveness of the proposed control scheme in managing the power flow and minimizing its fluctuations.

Weighted Memory Polynomial Model for RF Power Amplifiers Behavioral Modeling

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Abstract

Power amplifiers (PAs) are a major source of transmitted signal nonlinear distortions and channels interferences. This nonlinear distortion appears as an in band and out-of-band distortions in the frequency domain. In today's wireless communication systems where the linearity requirements are becoming more stringent, linearizing the PA is unavoidable to ensure high linearity and acceptable power efficiency performance. One way to achieve linear amplification is to back off the power amplifier so that it would work in its linear region. However, in such case, linearity is achieved at the expense of degrading the power efficiency of the PA. Therefore many techniques have been proposed in the literature to achieve the linearity requirements while maintaining relatively high power efficiency. Among the linearization approaches, the pre-distortion technique has gained popularity in the scientific and industrial communities. Pre-distortion technique uses a non-linear function (pre-distorter) before the PA so that their combination will lead to a linear relation between the input and the output of the cascade made of the predistorter and the power amplifier. The ideal pre-distorter function is the complementary function of the PA model. Thus, in order to ensure high performance predistortion, it is essential to understand and be able to accurately model the behavior of the power amplifier.

In this paper, a new memory polynomial based model labeled weighted memory polynomial model is proposed. In this model, an extra degree of freedom is given to the conventional memory polynomial model by giving more weight in the static nonlinear function of the model to input samples that contribute more to the static behavior. Similarly, the proposed model also gives more weight in the dynamic function of the model to the input samples which have a more significant impact on this component of the PA behavior. Measured input and output waveforms of a GaN based Doherty power amplifier driven by a 20 MHz long term evolution (LTE) signal were used to validate the proposed model. The results show that the proposed model leads to a 3-dB improvement in the NMSE performance when compared with the conventional memory polynomial model.

A Novel MOPSO Based on Mutual Information & Entropy for Medical Image Registration

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Abstract

Image registration is a vital and important division of medical image processing that has tremendous applications in both disease diagnostic and surgical operations. As medical Imaging modalities vary widely in their physical principles, they produce images with different characteristics that have complementary information. Registering two or more of these images, is an essential step before deducing any valuable information. Although, accurate schemes for mono-modal image registration have been widely proposed and studied, obtaining acceptable results in multimodal image registration remains a challenge. In this work, we are suggesting the use of multi-objective PSO algorithm to rigidly register images based on maximizing their mutual information and minimizing their joint entropy. Various experiments have been tested and this new technique seems very promising. Recommended improvements include considering larger data set for validation and automating the parameter selection strategy .

Identification of Nonlinear Power Amplifiers Using the Particle Swarm Algorithm

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Abstract

This work investigates the use of the popular Particle Swarm Optimization (PSO) algorithm for the purpose of identifying highly nonlinear Power Amplifiers (PA) exhibiting memory effects in addition to amplitude nonlinearities. For this purpose, a nonlinear Doherty PA modeled using the Memory Polynomial (MP) model is identified using the PSO algorithm and after identifying the shortcomings of that approach, several PSO variants are then proposed and studied in comparison to the traditional adaptive filtering-based identification techniques and each other in terms of identification accuracy, computational cost and stability. The standard and proposed PSO techniques are found ,through extensive simulations, to generally outperform adaptive filters, with the difference being more pronounced depending on the situation

Earth Science Department

A REVIEW OF ENVIRONMENTAL ASPECTS OF ENHANCED OIL RECOVERY AND PRODUCED WATER

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Abstract

Increased fossil energy requirements necessitate optimizing oil recovery from oil reservoirs/wells using various enhanced oil recovery (EOR) methods. Development of EOR techniques has always concentrated on increased production efficiency at the expense of our environment. All the available methods have impacts on the environment causing pollution in different ways. This study reviewed available information on thermal, microbial, chemical and gas injection methods of EOR with a view to assess their associated pollution potentials. Thermal methods cause substantial air pollution while microbial EOR approach is associated with plugging and corrosion of well plants. Use of CO_2 as injection fluid in EOR is becoming popular and it holds potentials to solving global warming challenges through the capturing of anthropogenic atmospheric emission of CO_2, a novel approach called carbon capture and storage. Nevertheless, apart from global hazards related to CO_2 pipeline leakage, CCS may also affect underground water, earth and living environments of the storage location. This review highlights need for research to establish the effects. Produced water is greatest waste generated in oil production and EOR. It can be recycled or re-injected, reused for ecosystem reclamation and development or treated by physical, chemical or biological methods to meet other domestic and industrial uses. Future studies should concentrate on cost-effective adaptation of Microbial Enhanced Oil Recovery (MEOR) which generates lesser waste, and on reuse of produced water for ecosystem reclamation. Summarily, this review brings together papers on different (often overlooked) environmental consequences of EOR methods and makes case for a need to consider the environment in our ambitious attempts to improve oil production.

GRAVIMETRIC ASSESSMENT OF PARTICULATE MATTER IN INDOOR ENVIRONMENT OF THIN-SECTION LABORATORY OF KFUPM

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Abstract

The Presidency of Metrology and Environment (PME) Saudi, does not state any limit/standards for particulate matter (PM) in indoor environment. This research therefore, attempts to assess indoor air quality to see any threat to workers' health and then advocates for setting of standards. Three different size-based types of particulates (TSP, PM_{10} and $PM_{2.5}$) were collected in indoor environment of Thin-Section Lab of KFUPM using High Volume Air Sampler. The collected samples were gravimetrically analyzed and compared with Saudi PME and other international standards for ambient air. The mean amount of TSP was found not only to be the highest and but also the most varied. The mean concentrations of TSP, PM_{10} and $PM_{2.5}$ were found to be $145^{\pm 55}$ μgm^{-3}, $117^{\pm 24}$ μgm^{-3} and $31^{\pm 6.3}$ μgm^{-3} respectively at $p = 0.05$. Fine and coarse particulates were just within PME standards but exceeded international standards and overall ranking of the amount of ultrafine particulates collected falls within Action Recommended for Sensitive Group. This paper contributes to literature on indoor air quality in Saudi and also makes case for a need to establish regulations for indoor air quality in workplace.

Biofuel Production-A Review

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Abstract

The world still depends on fossil fuels to supply 80% of the primary energy consumed today. These petroleum-based fuels however are not renewable and this necessitates the need to find a renewable source of fuels that will reduce the pressure on petroleum-based fuels. Biofuel production stands out to be the likely replacement in the foreseeable future, though; it is not without its limitations. Biofuels represent a source of secure, independent, and sustainable energy that is believed to have the ability to reinvigorate global agriculture, reduce soil erosion, expand wildlife habitat, and significantly reduce greenhouse gas emissions. The attention of the people has shifted towards the use of biofuels in the twentieth century as a result of rising prices of crude oil, emission of the greenhouse gases by fossil fuels and concerns about global warming and climate change, and interest of people in rural development. The issues on biofuel production, as claimed by some researchers, include choosing between food and biofuel since most of the plants currently used for biofuel production are food crops, large impacts on the biological diversity, Competition for fresh water by biofuel crops, local and regional water pollution, and local and regional air pollution. Despite these limitations, the future energy still depends on our ability to explore all the opportunities provided by biofuels. Therefore, more researches in the area of next generation biofuels are needed to ascertain the environmental implications of the production of these biofuels since current research works are not conclusive as to these environmental implications.

ASSESSMENT OF INDOOR MICROBIAL LOAD IN KFUPM

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Abstract

The physical, chemical and biological properties of the indoor environments can affect the health and wellbeing of the public. Indoor exposure to microorganisms and microbial components has been related to several adverse health effects such as respiratory diseases. Microorganisms are the primary sources of indoor air contamination. The aim of the study was to assess the microbial load in the indoor air environments of healthy buildings in KFUPM purposely selected.

A cross-sectional study was conducted to collected samples of airborne microorganisms using impaction plate method. Sample was collected from seven locations on April 17, 2012 between 7:00-8:00 AM, 1:00-2:00 PM, and 5:00-6:00 PM. Triplicate samples were collected for each location and time, after 30 minute exposure of the plate. Samples were incubated at 37 °C for 24-48 hours. The colony per plate was counted, appearance, form, elevation, and margin of the colony was also observed. The shape of the bacteria was also identified at 40 times magnification under microscope.

The highest colony count was observed in the cafeteria (192±11 cfu/plate at 7:00-8:00 AM) and the lowest count was observed in the laboratory (0±1 cfu/plate at 5:00-6:00 PM), and in the class room (1±2 cfu/plate at 5:00-6:00 PM). The colony form, elevation, and margin were circular, convex and flat, and entire respectively. The majority of the colony appearances were white. The *coccus* is the commonest bacterial shapes observed.

Further study should be conducted to quantify the bacterial load per volume of air, measure humidity, time variability, different season of the year, and test biochemical and PCR.

Adsorption Nanotechnologies application in water treatment: A review

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Abstract

It is clear that nanotechnology shows incredible promise to serve the growing demands for potable water and the quality of life for millions of people in the most underserved areas of the world. The uses of nanotechnologies play a large role in averting the coming water crisis. The invent of nanotechnology promises to dramatically enhance in any water purification technologies such as adsorption, ion exchange, oxidation, reduction, filtration, membranes, and disinfection processes. The aim of this review would highlight the uses of nanotechnology in adsorption of water pollutant and to identify the current gap. More than 15orginal articles and one review paper were collected from the free accessible journals and websites. From these papers only 6 of the original articles and one review paper were reviewed for the purpose of this subject. The need of further research was clearly understood and recommended in this paper.

Characterization of Reservoir Quality from the Outcrop Analog for the Paleozoic Sarah Formation Glacial and Fluvial Reservoirs, Qasim Area, Saudi Arabia

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Abstract

The outcrops of Late Ordovician Sarah Formation are located mainly in Al-Qaseem Area, Central Saudi Arabia. Their thicknesses vary between 90 to 300 m. The formation is composed mainly of fine to medium-grained sandstones, associated with glacial and marine tillite facies. The aim of the study is to describe and characterize the sedimentological and stratigraphical heterogeneity from outcrop reservoir analogs of the Late Ordovician Sarah Formation for the purpose of describing rock heterogeneities and characterizing and predicting reservoir quality. Field samples were collected from three main paleochannels in the area. Core plugs were tested for porosity and permeability. Thin sections were prepared, described, and interpreted. Lithologically, the facies ranges from brownish to reddish, silty, fine to coarse grained quartz arenites with clay cement not exceeding 5%. Thin section petrography showed good correlation between the textural variability and porosity and permeability measurements. Both depositional and diagenetic controls have impacted porosity and permeability patterns in Sarah Formation. These factors include grain size, sorting, cement and matrix content, pore size distribution and their connectivity. Understanding all these controls might help to assess and predict Sarah reservoir quality in the subsurface. However, further laboratory work was warranted.

Stable Oxygen and Carbon Isotope Evidence: Indicators of Cementation Environment of Holocene Beachrocks in The The Arabian Gulf and The The Gulf of Aqaba

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Abstract

This paper aims at unraveling and comparing Holocene beachrocks from the Arabian Gulf and the Gulf of Aqaba and explain the mechanism that influence the cementation process in both areas. Holocene beachrocks in the the Gulf of Aqaba are composed of predominantly terrigenous material that derived from erosion of adjacent uplifted Pre-Cambrian basement, while the beachrocks in the the Arabian Gulf are composed mainly of marine bioclasts and wind-blown siliciclastic sands. The cements of beachrocks in both areas show three textural varieties: 1). Isopachous phreatic acicular aragonite; 2). Micritic envelope of high-Mg calcite (HMC); 3). Meniscus and gravitational vadose HMC. Radiocarbon dating of beachrocks samples from the Arabian Gulf yielded ages from ca. 655 to 2185 yr BP whereas samples from the Gulf of Aqaba range in age between 2745 and 5075 yr BP. Oxygen isotopic values have various ranges from +2.65 to +4.40 ‰ respectively for the Arabian Gulf whereas the Gulf of Aqaba values ranges from +1.16 to +1.50 ‰ and 3). Carbon isotopic values have ranges from +3.22 to +5.90 ‰ for the Arabian Gulf whereas those from the Gulf of Aqaba range from +3.83 to +4.64 ‰ . The values of δ18OVPDB and δ13CVPDB signatures of beachrocks in both gulfs are suggestive of a marine origin. The beachrocks of the Arabian Gulf was precipitated under high evaporation condition, while beachrocks from the Gulf of Aqaba was precipitated under normal shallow marine condition. The mineralogy and textural habits suggest that cementation of these beachrocks may have started within shallow marine phreatic zone.

SEM/EDS and XRD Analysis of KFUPM Rus Formation

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Abstract

The paper summarize of the research carried out using Thin Sections, Scanning Electron Microscope/Energy Dispersive Spectroscopy (SEM/EDS) and X-ray diffraction (XRD) analysis. The task was completed by team work of all colleagues. A team of 5 students were assigned to analyze the rock samples of different locations of Rus Formation within KFUPM. The sample were collected and thin sections were prepared. Samples were also analyzed in the SEM/EDS and XRD laboratories. The results of SEM/EDS analysis exhibit that the rock contains calcium, magnesium, and oxygen. The analysis of XRD resulted in Dolomite and Quartz minerals present in rock samples of Rus Formation. The minerals depicted carbonate origin of the formation with varying quantities of quartz. The rock is homogeneous compositionally along the lateral direction. It is highly porous and contains air trapped in it. It is mostly composed of dolomite with some content of quartz.

Land Use Adaptation to Climate Change in the Urban Waterfront

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Abstract

In 1960s, industrial era left urban water's edge problematic, today, after years of revitalization, waterfront development is a booming phenomenon. In many countries, the development successfully regenerates area's economy as well as provide livable community for its citizens. Yet, nowadays, climate change issues emerge as a phenomenon that would threat the sustainability of urban waterfronts. This study tries to seek an appropriate form of land use planning to deal with the climate change in urban waterfront areas. Five tasks are generated in order to adapting land use plan to climate change. In this paper I extensively used available recent literature in English. Two case studies from waterfront development in New York City, US and Toronto, Canada will be examined to take lesson from on how to prepare land use plan in dealing with changing climate.

A Critical Study on the Functional Design of Eskan Project in Dammam

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Abstract

The past few decades have witnessed a paradigm shift in housing policies within developed and developing countries. Governments over the years have focused on policies geared towards ensuring housing supply and affordability to citizens. It is thus not surprising that housing has become an issue of tremendous political concern and the central feature of social policy and effective governance. Indeed, there are dynamic forces operating in the housing sector that have profound impact on the functionality of every housing design in a given geographical location. The Dammam community was observed be challenged with unavailability of affordable housing hence the Eskan project was the Saudi Government's bold response to the problem of housing supply and affordability. Amazingly and paradoxically, after 30 years of construction, Eskan Dammam looks like isolated islands of buildings. Obviously, between the building-blocks there appear to be little or no functional interaction. However it turns out that people began living in the multi-storied buildings after the gulf war in 1994. Thus this has been adapted gradually to the housing standard in Saudi culture. Although the rationale behind the observed slow adaptation process is not clearly known, the apparent dissolution of contemporary family size from extended to nuclear family system could be a probable cause of the desire to live in apartment buildings with reduced household population. The study is intended to explore the trajectory of the observed steady adaptation process to Eskan Dammam design and functionality.

Participatory Process in Reshaping Policy for Urban Water's Edge Revitalization

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Abstract

A series of urban waterfront revitalization success story has opened many eyes of a great opportunity ingrained in this area. From a neglected area after industrial era then become an area that attracts many tourist and investment. Participatory process in this kind of urban waterfront redevelopment also unique, in the beginning public only paid little attention to this area, and today people start to reclaim their waterfront. Full and strong public participation also not guarantee the success of urban waterfront redevelopment. This paper tries to examine some urban waterfront stories and the participatory process that take place in it. The important key elements that contributed to the success were studied as well to find out the best way of how participatory process could be involved in urban water's edge revitalization. In this paper I extensively used available recent literature in English. Several case studies were taken from different countries which have different culture in planning process.

Petroleum Engineering Department

Estimation of Water Saturation Using Electrical Measurements Data of Core Plugs for Different Wells in Carbonate Reservoir Using Artificial Intelligence Technologies

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Abstract

Good estimation of water saturation is necessary for successful reservoir properties calculation that minimizes the error in initial oil in place calculations. Electrical measurements of core plugs have been used to predict water saturation by analysis of the parameters of Archie's equation. There are several methods to analyze these parameters using core plug data such as conventional, CAPE (1, m, n), CAPE (a, m, n) and 3D methods.

This study will focus on an aspect which was not fully covered in the literature: using Artificial Intelligence technologies to predict water saturation by using electrical measurements of core plugs. The data used in this study were collected from laboratory experiments that were conducted to determine the electrical properties of core plugs in carbonate reservoir rocks in the Middle East. 378 data points extracted from forty-one core samples obtained from 3 wells were used for the implementation of the proposed techniques. 70% of the data points were used to train the AI models while the remaining 30% was used for validation and test. The results show that the AI models performed better with higher accuracy and lower errors than those obtained with previous methods.

Evaluation of Properties of Nano particles admixed oil well cement under HTHP conditions

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Abstract

The principal functions of oil well cementing are to control fluid movement between zones within the formation and to bond and sustain the casing. Apart from these, the cement sheath also protects casing from corroding, protects the casing from shock loads when drilling deeper, and plugs lost circulation or thief zones. Once cement is placed in the wellbore, initial setting occurs wherein development of compressive strength becomes more important for further drilling operations.

The application of nano alumina in the concrete industry attracted the attention of the petroleum industry because of its high surface area which improves the strength of concrete. Nano alumina application in the petroleum industry is being considered as deeper wells are drilled which requires stronger cement sheath. Nano alumina improves the cement properties at normal pressure and temperature.

The purpose of this study is to evaluate the effect of nano alumina on the physical properties of cement at high temperature and high pressure conditions. In this paper, we have done preliminary experimental investigations of different cement slurry properties of class G cement such as free water separation, rheological properties, compressive strength, density, SEM analysis, XRD analysis, porosity, permeability and thin section analysis at atmospheric pressure and temperature conditions. The work is under progress and further we will add different percentages of nano particles to cement slurry and evaluate its effect on the physical properties of cement slurry at high temperature and high pressure conditions.

Design and Evaluation of Hydraulic fracturing in Tight Gas Reservoirs

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Abstract

Unconventional gas resources, tight gas reservoirs in particular, complements other major sources of hydrocarbon which if exploited effectively can play a significant role in meeting today's energy challenges faced by the world. The production of these foremost resources has many economical challenges, which could be overcome by the incisive use of on hand resources and technological efficiency. Hydraulic fracturing is requisite stimulation technique for the economic development of tight gas reservoirs. The understanding of hydraulic fracture design is critical because it is affected by many parameters.

This paper is concerned with the processes of treatment design and treatment evaluation, and in particular with the best practices that help optimize these procedures, including candidate selection depending on the well test and well performance analysis, measurements that make fracturing more successful, treatment design techniques and proppant design and selection depending on the economic optimization of design. Finally, the financial analysis of fracture job with net production increase explains the best stimulation solution for tight gas reservoirs.

This paper will serve as a good source of information to those engineers who wish to achieve a better understanding of hydraulic fractures or desire to capitalize on the economics of their completions in tight gas reservoirs.

Evaluation of the Pressure Drop due to Multi Phase Flow in Horizontal Pipes Using Fuzzy Logic and Neural Networks

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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 hold up especially in hilly terrain and rough environment that will complicate the flow regime and make negative impact on well productivity. 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. This paper describes the utilization of Fuzzy Logic and Neural Networks, 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 oil fields. More than 240 published real well testing data were used in constructing the model.

After filtering the data and building the model, the newly developed AI model was the best method to predict the multiphase flow pressure drop. Prosper software was used to confirm the validity of the AI methods over the other existing correlations. The final results confirmed that Adaptive Neuro-Fuzzy Inference System (ANFIS) is more accurate than all the used correlations and Neural Networks. The ANFIS model resulted in .4% absolute average error compared to a range of 17.5% - 64.57 % for the compared correlations.

Effect of Saturation on Acoustics of Carbonate Rocks

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Abstract

This study was carried out to analyze more than eighty outcrop samples from the carbonate Dam Formation in Al-Lidam area in the Eastern Province – Saudi Arabia for texture, mineralogy, and to investigate the influence of confining pressure on compressional and shear-wave velocities at room temperature. The methods used in this study included field investigations, facies analysis, petrographic analysis, petrophysical analysis, and acoustic data analysis.

The laboratory investigations revealed that Dam Formation in Al-Lidam area has four facies types including, mudstone, packstone, wackestone and grainstone. The measured porosity values range between 52% and 55% with an average value 38% and permeability values from 0.39 mD to 18 D, with an average of 3 D.

The results show that P-wave and S-waves velocities increase with the increase in confining pressure for dry samples. The P-wave velocity increased and the S-wave velocity decreased with confining pressure under saturated condition. This increase is non-linear with confining pressure. A regression equation of the form gives a good fit to the measured velocity when compared with equations suggested by other studies.

Well Placement Optimization in a Waterflood Project Using Particle Swarm Optimization Method

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Abstract

Optimal placement of production and injection wells during a waterflood project is a complex problem that not only depends upon geological rock, reservoir and fluid properties but also on parameters related to economics. An optimization technique for well placement can be used that evaluates and takes into consideration all the above parameters. However optimization technique is highly demanding in terms of computational requirements. In this paper, particle swarm optimization algorithm is applied to optimize the locations of production and injection wells. The PSO algorithm is a stochastic procedure that uses a population of solutions, called particles, which move in the search space. Particle positions are updated iteratively according to particle fitness (objective function value) and position relative to other particles. The general PSO procedure is first discussed, and then the particular variant implemented for well placement optimization is described usign five example cases. Taken in total, these findings are very promising and demonstrate the applicability of PSO for this challenging problem.

Optimizing the Flow Rate of Wells: An Implementation of Particle Swarm Optimization Technique

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Abstract

The energy industry is advancing rapidly with continual research and innovations regarding to new technologies and their utilization with the purpose to optimize the required parameters. A practicing petroleum engineer always try to optimize the well and reservoir performance with the purpose to increase the recovery. One very important component associated to it, is well rates (can be well flow rate or injection rate depending upon its type). This has significance importance as we need to find out the optimum rate which can lead to better reservoir management and development.

This paper highlights one of such technique which can be utilized for the optimization of well flow rates based on the reservoir model. The Particle Swarm Optimization (PSO) technique is a global optimization procedure that uses a population of possible solution (particles). It contains an iterative procedure during which the possible solutions are updated and converges towards the best, based on some pre-defined objective function. This paper will brief you about the general PSO procedure, and its implementation for flow rate optimization. It will also highlight its diverse utilization and applicability in other scenarios, in which the oil industry can be benefitted from it.

Effect of Pressure on Wormholes in Carbonate Rocks - Stretching the Experimental Limits

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Abstract

Matrix acidizing is a classic stimulation technique through which the permeability of a formation is altered by injecting an acid which result in dissolution of rock. In carbonate reservoirs, this process actually creates flow channels for the hydrocarbons in the near wellbore area known as "wormholes". The objective of this proposal is to study the phenomenon of "wormholing" in deep carbonate formations.

The primary focus is to establish good understanding of the rock dissolution under high pressure and moderate temperature conditions for tight reservoirs. There are various

parameters involved in such studies which include but not limited to the flow rate of acid, the concentration of the acid, rock type, rock properties, temperature and pressure. As mentioned, the study will be carried out at high pressure for low permeability carbonate reservoirs. There have been vast studies reported in the literature; however, experiments with as high pressure as proposed here have not been conducted before.

In this project, we studied the propagation of wormhole by conducting experiments using new core flow equipment capable of simulating reservoir conditions. Primarily pressure

was varied from 1000 psi to 5000 psi in these experiments to assess the effect on wormhole propagation, the volume to breakthrough and the morphology of the wormhole. These experiments provided new insights specifically into the influence of CO2 on the wormhole penetration rate depending upon its phase which again is a very pressure dependent phenomenon. The data generated can also be used to see how accurate the models in literature are at high pressures because these models have never been validated at high pressures. CT scans were used to observe the wormhole morphology

Application of Global Optimization technique to Pressure Transient Analysis in Homogeneous Formations

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Abstract

Transient pressure analysis has been used for decades to estimate relevant well and reservoir properties. These properties are: average reservoir permeability in the neighborhood of the well, skin damage around the well, wellbore storage coefficient and external reservoir radius. Well test analysis has been mostly done using nonlinear regression. The problem with this is that nonlinear regression is a local search algorithm and yields a local estimate of the unknown well and reservoir parameters. Such local estimates are often found in the vicinity of the initial guess. On the other hand, stochastic optimization algorithms have the ability to find the global optimum point.

In this research, we will propose the use of global optimization technique Differential Evolution (DE) algorithm to find out the values of average reservoir permeability, skin damage near wellbore, well bore storage coefficient, drainage radius etc. Optimal values of reservoir and well parameters are obtained from well tests conducted in homogenous cylindrical reservoir systems. We considered two homogeneous reservoirs, one with an infinite-acting boundary and the other with a closed boundary; all the cases assume constant rate condition.

The performance of algorithms was compared with traditional non-linear regression by running each algorithm on each sample problem 25 times. All the algorithms were also initialized randomly with a specified bound. Estimates from the 25 trials were compared. Results obtained showed that the Differential Evolution has a greater ability to accurately estimate well and reservoir parameters.

Significantly, the approach indicates that global optimization algorithms are much better for transient pressure analysis as it has the ability to escape several local minima. Based on the best performing algorithms among other global optimization techniques hybridization could be made between them to increase their computational efficiency.

Optimization of ICV Configuration Using Particle Swarm Optimization Technique in A Multilateral Well Formations

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Abstract

A 'smart' or 'intelligent' well is considered one of the most advanced types of nonconventional wells. These wells are equipped with smart completions; provide great potential to improve the recovery from hydrocarbon resources. Smart wells provide the ability to control uncertainties associated with reservoir heterogeneity. One example is to mitigate unexpected water production due to fractures and hence increase the ultimate recovery. This is achieved by selectively controlling production from multiple laterals. Due to subsurface communication between laterals that have different productivity indices, it is difficult in practice to optimize production from smart wells. The optimization of smart wells involves more than one parameter. These parameters include the settings of the downhole inflow control valves (ICV) that act as a subsurface chokes.

This paper focused on the reservoir engineering aspects of finding the optimum ICV configuration that optimizes reservoir performance parameters by minimizing the water cut of a multilateral well. An optimization technique for ICV configuration can be used that evaluates and takes into consideration all the above parameters. However optimization technique is highly demanding in terms of computational requirements.

In this paper, particle swarm optimization algorithm is applied to optimize the ICV valves settings. The PSO algorithm is a stochastic procedure that uses a population of solutions, called particles, which move in the search space. Particle positions are updated iteratively according to particle fitness (objective function value) and position relative to other particles. The general PSO procedure is first discussed, and then the particular variant implemented for ICV valves optimization is described using an example. Taken in total, these findings are very promising and demonstrate the applicability of PSO for this challenging problem. The commercial reservoir simulator Eclipse is used as the objective function evaluator that assesses how good an ICV configuration is.

Improving Well Performance through a Hydraulic Fracturing job that is Efficient and Economical

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Abstract

Hydraulic Fracturing is one of the stimulation methods used for enhancing hydrocarbon production. Previously this treatment was based on the optimization of fracture geometry. Now on the basis of Unified Fracture Design (UFD), treatment sizing is based on dimensionless fracture conductivity; with the best variable to characterize the size of fracture being the volume of proppant placed in the 'pay' rather than length and width, as the fracture geometry that would maximize production is unique for a particular mass or volume of proppant.

The purpose of this research is to design an effective and economical hydraulic fracturing job by selecting the amount of proppant that results in optimal treatment sizing, at which the Net Present Value (NPV) of incremental revenue balanced by treatment cost is maximum. This would include selecting the appropriate proppant number which would give the best productivity index while the chosen proppant volume is placed according to the optimal dimensionless fracture conductivity.

Without going into the unnecessary details of fracture mechanics, fluid rheology or reservoir engineering we will design the fracture by taking basic decisions in an iterative manner. This research has great scope in designing hydraulic fracturing job for different permeability formations and using different kinds of proppants.

EFFECTIVENESS OF MULTIPLE EXPANSION CHAMBERS IN REDUCING NOISE

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Abstract

Silencers with expansion chambers are often used to reduce noise in different applications such as HVAC, exhaust systems, and car muffler systems. This study focuses on the effectiveness of multiple expansion chambers in reducing noise. Methods for enhancing silencer designs are realized by changing expansion chamber cross sectional areas and changing the lengths of the expansion chambers. General guidelines for design enhancement are provided through this study.

Development of a novel hybrid storage system for aqua-ammonia solar absorption refrigeration cycle

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Abstract

This paper proposes a novel hybrid storage system for aqua ammonia absorption refrigeration cycles capable of providing continuous refrigeration that is powered by solar energy. The cycle integrates a cold storage tank with two aqua ammonia storage tanks and an ammonia storage tank to accommodate a 24-hour uninterrupted daily cooling load. During the daytime, solar energy is used to provide the refrigeration that suffices both the daily cooling load and the production of both ammonia and ice for the night cooling load. The cold storage tank together with the ammonia and aqua-ammonia tanks share the night cooling load. The proposed combined refrigerant and cold storage cycle results in downsizing the storage tanks for the same cooling capacity compared to the currently available storage designs. The proposed novel hybrid storage technology will provide refrigeration even if any of the two storage systems cease to operate or need maintenance. The impact of different configurations of shared cooling load on the size of storage tanks has also been investigated. Further studies towards performance and economic optimization of the hybrid storage absorption refrigeration system will be carried out in future.

Overcoming the problem of agglomeration in Ni-Al_2O_3 nanocomposite powders

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Abstract

Attractive physical and mechanical properties such as high specific modulus, strength-to weigh ratio, fatigue strength, thermal stability and wear resistance can be obtained with metal matrix nanocomposites (MMNCs). However, agglomeration and poor dispersion of the reinforcement in the matrix remains a major problem in processing metal matrix nanocomposites with the desired properties. The objective of the present work is to prepare homogenous Ni-Al_2O_3 nanocomposite powders with uniform distribution of Al_2O_3 nanoparticles through mechanical alloying, a solid-state powder processing technique which involves repeated welding, fracturing, and rewelding of powder particles in a ball mill. Nickel micron-size powder and Al_2O_3 nano-powder were ball milled to prepare Ni-Al_2O_3 nanocomposite powders. The milling experiments were carried out at room temperature in argon atmosphere to prevent the oxidation of the powders. A ball to powder weight ratio of 10:1 and a speed of 300 rpm were used. The morphology of particles and distribution of Al_2O_3 nanoparticles in the ball milled powders were characterized using FE-SEM and x-ray mapping. The evolution of the grain size of the Ni matrix was followed through x-ray diffraction. Analysis and characterization of the prepared nanocomposite powders showed that ball milling is not only an effective technique to prepare homogenous Ni-Al_2O_3 nanocomposite powders with uniform distribution of Al_2O_3 nanoparticles but also to reduce the grain size of the Ni matrix to less that 100 nm.

Simulation of flow periodicity over a 2D corrugated surface using Reynolds Stress Model (RSM)

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Abstract

This paper investigates the periodicity of a turbulent flow regime over a 2D surface of multiple constrictions. The flow domain is modeled using the same dimensions and flow parameters as used in the experiments performed by Almeida et al. The turbulent flow is modeled using a Reynolds Stress Model at Re = 60,000. A fully developed flow is considered at the inlet of flow domain and a no slip condition is assumed on the walls. The mesh is developed on GAMBIT using 145200 structured hexagonal elements. The results show the presence of high turbulent kinetic energy and Reynolds stresses near the dip of corrugations. The periodicity is achieved for flow velocity, Reynolds stresses and turbulent kinetic energy. The results for turbulent flow regime are validated from the experiments performed by Almeida et al.

Experimental study of dust and its impact on optical properties of flat glass used in PV panels

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Abstract

Performance of PV panels is degraded by more than 50% due to weather conditions in the Kingdom of Saudi Arabia. Literature shows that dust sedimentation on PV panels affects the transmittance of light, thus reducing the amount of photons absorbed. The present study deals with the comparison of soiling effect of plain flat glass specimen at different heights and locations in KSA environment for one month. To validate this concept, a setup is designed and installed to hold glass specimen at three different heights of 0.5 m, 1.0 m and 1.5 m and at two different locations i.e. KFUPM campus and KFUPM beach in Dhahran, KSA. The transmittance of light and the transmitted power through each glass is analyzed and measured using spectrophotometer and radiometer respectively. The chemical characterization and composition of sand on the flat plain glass specimen is studied experimentally using Energy Dispersive Spectroscopy (EDS) and X Ray Diffraction (XRD) techniques. The initial results show that the transmittance of light strongly depends on dust deposition, site location and exposure period. This study may lead to further investigation on the development of a self-cleaning material.

Study of Soiling Effect on Light Transmittance of Solatex Glass Used in the PV Panels

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Abstract

The performance of solar panels can be affected drastically by the environmental conditions such as the temperature, humidity, and dust. The dust that accumulates on the surface of the panel leads to the reduction of the transmitted light and the decrease of the output power. The soiling effect on the panel performance is particularly important in Saudi Arabia because of the frequent sand storms, dusty weather and high humidity.

Our study aims at achieving a good understanding of the various factors affecting the interaction of dust with the surface of Solatex glass that is used in solar panels in the region of Dhahran. The samples were placed at 0.5m, 1m and 1.5 m heights from the ground at two different sites, one close to the Arabian Gulf and the second inside the campus region. The chemical composition, size, and shape of the grains of the dust accumulated on the glasses were periodically analyzed using XRD, Profilometer, Scanning Electron Microscopy (SEM) and Energy Dispersive Spectroscopy (EDS). The transmittance of the exposed glasses versus wavelength was measured using a UV-visible spectrometer. The power transmitted of the exposed glass was measured by radiometer. The results showed a reduction of the power transmitted as high as 2.73%, 4.37%, and 3.83% for sample at 1.5 m, 1.0 m, and 0.5 m, respectively after 24 days exposure to sunlight and rainy day. While the amounts of the decreased power affected by the accumulation of dust on the beach samples are 8.63%, 8.25% and 7.07% for 1.5 m, 1.0 m, and 0.5 m respectively. XRD and EDS result showed the element composition of the dust accumulated on the glasses that placed in the campus region, such as Calcium in the form $CaCO_3$, Iron ($FeSiO_3$), Potassium (KO_2), Sodium, Magnesium, Silicon(SiO_2), and Aluminum. This study will help us develop strategies to minimize the soiling effect on panel performance.

Status of mechanical subcooling in improving performance of vapor compression systems

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Abstract

Using mechanical sub-cooling systems to increase COP of vapor compression cycles is a known method in literature to save energy and increase efficiency. Recently, much progress has been made with respect to investigation into its different aspects that can help to put it into practice. Two numerical and one experimental work are considered for the purpose of highlighting this progress. The first numerical work considered is a simulation of performance characteristics resulting from different refrigerant combinations in dedicated mechanical sub-cooling systems. The second numerical work is related to variation in performance characteristics in a vapor compression cycle with integrated mechanical sub-cooling because of fouling. The third work highlighted is an experimental investigation into effects of employing a dedicated mechanical subcooling cycle with a residential 1.5 ton simple vapor compression system. Some important results from these works are discussed. Finally, some suggestions are made to provide direction into future research in this area to help putting it into practice.

PREDICTION OF TWO-PHASE FRICTION PRESURE DROP MULTIPLIERBY USING LOOK-UP-TABLE

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Abstract

Accurate prediction of two-phase friction pressure drop requires knowledge of the Two-Phase Friction Pressure Drop Multiplier, Φ^2_{LO}, used for calculating two-phase friction pressure drop. Many Correlations and models are previously made to predict the two-phase friction multiplier, but the problem that there is inconsistency in prediction as the models perform adequate for some regions and non-adequate in others. Therefore, it is needed to construct a single component two-phase look-up-table, to predict the two-phase frictional pressure drop multiplier. A skeleton table for $\Phi^2_{LO}(DR, \mathrm{Re}, x)$ was constructed using leading correlations. The table then was updated with available experimental data which are enhanced to reduce the error in correlations predictions. Three dimensional smoothing was applied on the updated table. Detailed error assessment of the table was presented with comparing its predictions against experimental data as well as leading models and correlations. As a result, constructing such a table guarantees covering wide ranges of flow conditions with error 7% lower than the best prediction among existing models and correlations.

The Effects of Different Refrigerants on the Rate of Water Extraction from Evaporator Coil

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Abstract

This paper examined the effects of different refrigerants on the rate of water yield from evaporator coil of an air conditioning system operating in hot and humid climates. Refrigerant R22 and its alternatives (R407C and R410A) are considered. In a cooling process, water vapor condensation normally occurs when the evaporator coil surface temperature is lower than the dew point of the humid air entering the evaporator. In this article, water yield due to air dehumidification on a finned-tube evaporator coil was calculated using a mathematical model that relates the coils geometry and the fluid flow parameters. The water yield was obtained using actual climate data of three typical summers humid and hottest days with a day selected from each of the month of June, July and August for Dhahran, kingdom of Saudi Arabia. The hourly variation of water yield followed similar trend to that of relative humidity where the maximum yield occurred during early morning hours. It was found that the process of cooling humid air on cold surfaces can results in appreciable amount of condensate which can serve as an additional water source. For a typical day in August with refrigerants R22, R407C and R410A, the cumulative water yield was found to be 178, 160 and 151 kg, respectively. Increase in the volumetric flow of air also increases the rate of water yield from the coils.

THE PRESSURE DROP BEHAVIOR IN OIL-WATER FLOW FOR LOW VISCOSITY OILS

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Abstract

The pressure drop of oil-water flow behavior for low viscosity oils was experimentally investigated. Experiments were conducted to measure the flow pattern and the pressure drop in oil-water flow in an acrylic horizontal 2.25 cm diameter pipe. The used oil has a 781 kg/m^3 density and a 1.85 cP viscosity (at 25 ^{0}C). The Results showed that the pressure drop decreases as the oil fraction approaches inversion point. At inversion point, the pressure drop increases and then decreases generating a peak. The experimental data were compared with several models and correlations for the mixture viscosity such as the homogenous model, Pal model, and Phan and Pham model. These models gave large error in predicting the pressure drop results of the present study and other studies with low viscosity oil. A new correlation for the mixture viscosity was developed in the present work which suits better the oil of low viscosities. The new correlation of mixture viscosity when used for predicting the pressure drop for low viscosity oils produces much less error than those available in literature.

THE EFFECT OF WATER SALINITY ON THE FLOW PATTERN AND THE PRESSURE DROP IN OIL-WATER FLOW

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Abstract

The effect of water salinity on the flow pattern and the pressure drop in oil-water flow was investigated experimentally in an acrylic 2.25-cm diameter horizontal pipe. The used oil has a 781 kg/m^3 density and a 1.85 cP viscosity at 25 ^{0}C. Water salinity was increased to 75 ‰ by mixing food salt with an amount of 9% of water weight to the water tank. The addition of the salt increased the density of the water from 999 kg/m^3 to 1065 kg/m^3, and the viscosity to change from 0.985 cP to 1.246 cP (at 23.5 ^{o}C). This caused the oil-water density ratio to change from 0.78 to 0.732 and the viscosity ratio to change from 1.94 to 1.536. The Results showed that salinity delayed the transition from Dispersion of oil in water over a water layer flow pattern to the Dispersion of water in oil and oil in water to the flow pattern. Also, it was noticed that the waves in the stratified with mixture at the interface flow pattern in saline water has less amplitudes than that in tap water. Results for the pressure drop showed that inversion point location was noticed to start earlier in saline water than in tap water, and the decrease rate in the pressure drop as the oil fraction approaches the inversion point was reduced in saline water. This means that inversion effect was reduced. However, since saline water density is greater, greater pressure drop was produced.

LIFE PREDICTION OF A PHOTOVOLTAIC MODULE

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Abstract

A Photovoltaic (PV) module consists of layers of different materials constrained together through an encapsulant polymer. During its lamination and operation, it experiences mechanical and thermal loads due to seasonal and daily temperature variations, which cause breakage of interconnects owing to fatigue. This is due to the fact that there is a coefficient of thermal expansion (CTE) mismatch because of the presence of unlike materials within the laminate. Therefore, thermo-mechanical stresses are induced in the module. The lifetime of today's PV module is expected to be 25 years and this period corresponds to the guarantee of the manufacturer. Its high reliability will help it to reach grid parity. But the problem is that it is not convenient to wait and assess its durability. In this work, material of each component of PV module is characterized and Finite-Element (FE) structural analysis is performed to find the initial condition of the components of the module after manufacture. It was found that the copper interconnects undergo plastic deformation just after the lamination process. A thermal model was numerically developed and sequentially coupled to the structural model. By using the meteorological data of Jeddah, Saudi Arabia, average life of PV module was estimated to be 26.63 years.

On the Modeling of Steam Methane Reforming (SMR): Review and Parametric analysis

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Abstract
Modeling and simulations of steam methane reforming process are presented in this article. The reduced simulation time with high model validity is the main concern in this study. A volume based reaction model is used, instead of surface based model, with careful estimation of mixture's physical properties. The developed model is validated against the reported experimental data and model accuracy as high as 99.75% is achieved. The model is further used to study the effect of different operating parameters on the steam and methane conversion. General behaviors of the reaction are obtained and discussed. The results showed that increasing the conversion thermodynamic limits with the decrease of the pressure results in a need for long reformers so as to achieve the associated fuel reforming thermodynamics limit. It is also shown that not only increasing the FH2O/FCH4 value is favorable for higher methane conversion but the way the ratio is changed also matters to a considerable extent.

OVERLAYER THICKNESS ESTIMATION USING XPS: A REVIEW

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ABSTRACT: Several methods have been proposed in estimating the thickness of an overlayer on a substrate using XPS with different formulations ranging from the common formalism from Beer-Lambert equation to the multiline approach. Most of these methods relate the overlayer thickness to the inelastic mean free path (IMFP) in the form of attenuation length which did not account for the effect of elastic scattering hence the observed difference from experimental results. In this review, we present the significant effect of the elastic scattering which negligence has always contributed immensely to the reduced overlayer thickness measurement by using Monte Carlo algorithm to capture the elastic collision influence and as well compare the different XPS models for estimating the overlayer thickness.

DEFECTS IN PVD HARD COATINGS

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Abstract

The increasing interest in the study of surface coatings is highly attributed to the profound benefit of improved surfaces quality. Coated surfaces are often of high corrosion and wear resistant and they exhibit improved surface toughness. Despite these merits, PVD hard coated surfaces are never free from growth defects, the presence of such defect in all coating methods; PVD, CVD, Sputtering and Electroplating, are known. The defects are non-uniformly distributed, while their form, size and density depend on the substrate position in the vacuum chamber, its pretreatment condition, orientation and rotation mode as well as the deposition conditions: time, technique and parameters.

Effect of uniform Axial Heat Flux on post dryout heat transfer

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Abstract

A study has been conducted on R134-a to understand the effects of uniform axial heat flux on post dry out heat transfer in vertical flows. Correlation was established which is applicable in the pressure range of 1600 kPa to 2400 kPa and mass flux ranging from 1000 to 4000 kg/m^{2}s. This correlation gives good prediction for subcooled liquid with a RMS error of 14% as compared to previous correlations like Dougall-Rohsenow whose error was 51%. The wall temperature was seen to be dependent on pressure and mass flux. Effect of subcooled inlet on wall temperature was also observed.

H_2S and CO_2 Corrosion: A review

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Abstract

H_2S and CO_2 corrosion are one of the current challenges the oil industries are facing. A review study was performed to bring together all the outcomes that have been published since now. The combined effect of CO_2 and H_2S is still ambiguous. The inhibition effect of H_2S was seen at low concentrations. Formation of protective film was dependent on pH, partial pressure, temperature, concentration. Mackinawite phase of iron sulphide was the dominant phase whenever H_2S was present. The corrosion effect of CO_2 was diminished in presence of H_2S. Higher corrosion rates were observed for high water cuts.

Effect of Dust on the Transmittance of PV Module Glass Cover

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Abstract

In this study ,the effect of dust deposition on the transmittance of glass used as cover for PV modules is presented. Dust chemical chomposition ,shape and particle size have been determined using Energy Dispersive Spectroscopy (EDS), Scanning Electron Microscopy (SEM), and Particle Analyzer respectively. Glass texture has been analyzed using (Atomic Force Microscopy) AFM. The results showed that the transmittance reduction after 45 days of exposure for coated glass is around 20% followed by uncoated glass with 32% and 35% for clear glass. Also the results indicated that the shape of dust particles take irregular and various forms but in general tends to be a spherical shape. Oxygen is the highest concentration followed by calcium, carbon and silicon elements. The particle sizing analysis showed that particles that have a diameter in the range of 0.578 µm to 0.972 have a major influence on the total area and particles that have a diameter in the range of 18.50 µm to 37.00 µm have a major influence on the total volume.

Effect of Annealing Temperature on Corrosion Behavior of Mn containing Austenitic Stainless Steel alloys

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Abstract

There are many factors that influence the corrosion resistance of austenitic stainless steels, such as composition, microstructure and annealing temperature. In this paper we have studied the corrosion behavior of specially designed austenitic stainless steels with low Nickel and high Manganese content. The alloys were annealed at two different temperatures, i.e. at 1030^{o}C for 2h, and 1050^{o}C for 0.5h prior to electrochemical investigations. Potentiodynamic polarization (PD) experiments were performed to compare the corrosion behavior of these alloys in two different environments. Corrosion Potential, Pitting Potential, Passivation Current and Corrosion Rates were determined and the results showed that with an increase in annealing temperature of the alloys, the corrosion rate decreased significantly.

Development of a Domestic Solar Air conditioner for Saudi Arabia

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Abstract

Saudi Arabia is well known of its extremely hot weather in the summer therefore; about 52% of the total electric energy production is consumed for air conditioning equipment. This may lead to hazardous consequences such as, increase of the greenhouse gases in the environment, depletion of fossil fuel resources, and other environmental problems. Currently, the traditional vapor compression air conditioning systems are the commonly used one in the kingdom. However, the use of solar energy to drive cooling cycles becomes attractive since the cooling load is roughly in phase with solar energy availability particularly in Saudi Arabia. The solar incident radiation has a very high rate in the kingdom which being estimated to be 5 – 7 kWh/m^2 day. Therefore, in our proposed senior design project, we aim to use the solar energy to derive an air conditioner for domestic application.

We started a survey about absorption cycles that use the thermal energy to derive a cooling effect. The thermal energy is supplied by solar collectors which may be of different types. A technical and market analysis performed on available solar collectors suggest to use vacuum tube solar collectors for the heating purpose. The performance evaluation analysis of the system showed that it is practical and economically reasonable. Therefore, we aim to build 1 Ton Refrigerant (TR) solar air conditioner using single stage absorption refrigeration cycle. The cycle uses lithium bromide as an absorber and water as a refrigerant. A detailed cycle analysis is performed and parametric study on the main control factors were carried out. A complete design of the main components of the cycle is in progress to build such system. These components are the absorber, generator, evaporator and condenser. Suitable material and engineering drawing are being prepared for manufacturing the system components. It is important to note that most of these components have been collected from scraped items and being retrofitted to our design. In addition, one of the project goals is to aware people of a vital alternative cooling system that uses the most available renewable energy source in our country, the sun.

Study of early bearing failure for a rod mill

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Abstract

Rolling process is commonly used in steel manufacturing. The rolled product may be sheet or different cross-section rods and bars. A rolling mill is required to perform the rolling operation. The roll is the vital part of a roll mill, which is subjected to high radial and tangential loads during the rolling operation. It is supported on bearings at its ends; therefore the quality of the product and performance of a roll mill is highly affected by the bearings. The bearing life is governed mainly by loading due to rolling operation and some other parameters like lubrication. Early bearing failure is an important problem for a rod mill facility as it has severe effect on productivity and quality of the rolling process. The present work covers the study of bearing failure for a rod mill facility. Different modes of failure are identified and one of the possible causes is investigated in detail to detect the related causes of failure.

Effect of Concentration and Process Parameters on the Mechanical and Surface Properties of Polyacrilonitrile (PAN) Electrospun Nanofiber Mats

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Abstract

In this study, the effect of PAN concentration on the surface and mechanical properties of electrospun nanofiber mats have been investigated. The increase in PAN concentration from 6 to 8% increases the tensile strength, failure strength and ductility of electrospun nanofiber mats by 206, 194 and 195% respectively. SEM micrographs were used to study the morphology. The increase in tensile properties is attributed to the decrease in bead formation with increase in PAN concentration in the nanofiber mats. The PAN concentrations investigated did not have any significant effect on the wet ability of the nanofiber mats.

Performance of a flat plate photovoltaic/thermal solar air heater (PV/T)

(Effect of vertical fins on a double pass system)

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Abstract

In this paper, the steady-state performance evaluation of a double-pass flat plate hybrid photovoltaic/thermal solar air heater (PV/T) with attached vertical fins at the bottom of the absorber in the lower channel. A simulation model for predicting the thermal and combined photovoltaic thermal performance of the system is presented and various performance parameters are calculated for a proposed PV/T for three fin profiles. The model could be easily extended to cover other fin profiles.

Effect of Phase Change Particle (P.C.M.) Injection on Heat Transfer Characteristic in Microchannel Flow: Laminar and Turbulent Flow

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Abstract:

In present study, effect of nanosize of phase change material (P.C.M.) on heat transfer in a microchannel flow is investigated. Discrete phase model (D.P.M.) is used to formulate momentum and energy equations for carrier fluid and P.C.M. particles, which are simultaneously present in the microchannel. The geometry of microchannel is constructed with height of 5 μm by 1 mm in length. Water is used as a carrier fluid and lauric acid is considered as P.C.M. particles in the simulations. The constant heat flux is introduced at the bottom of the microchannel and P.C.M. particles are injected uniformly from the inlet of the microchannel with same velocity and temperature as of the carrier fluid. The Nusselt Number and the wall temperature are calculated for four different volume concentrations of P.C.M. particles. It is found that as the volumetric concentration of P.C.M. increases, the Nusselt Number increases while the fluid temperature decreases. In turbulent flow regime the volumetric concentration of P.C.M. particles does not have considerable effect on the Nusselt number and the fluid temperature in the microchannel.

Experimental Studies on Solar Photovoltaic (SPV) Refrigeration System

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Abstract

The performance of a solar photovoltaic refrigeration system in Dhahran has been conducted for the 17th, 19th and 21st of January 2013 corresponding to winter days in the kingdom. The system has a very simple design which makes it affordable and cost effective. The orientation of the photovoltaic panel at solar noon is calculated to be 97.67%, 96.47% and 97.32% for 17th, 19th and 21st January respectively. Similar the PV panel efficiency at solar noon are 15.54%, 14.65% and 15.98%. The solar energy recorded on the days considered were sufficient to drive the vapor compression refrigeration system. The COP's obtained are 1.55, 1.49 and 1.47 for 17th, 19th and 21st January respectively. Similarly the refrigeration power calculated is 92.98W, 91.33W and 91.88W. The reason for this variation in the calculated COP values is due to the heat gained into the refrigerator cabin during the experiment. The results obtained give a positive indication for the development and deployment of solar photovoltaic refrigeration system in the kingdom for vaccine preservations, supermarkets, desert camping, in homes off the electric grid and several other purposes.

High Temperature Membranes for Oxyfuel Combustion

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Abstract

Ion transport membrane (ITM) based reactor is one of the developing technologies based on the principle of oxyfuel combustion for carbon dioxide capture and sequestration which integrates air separation and fuel conversion These ITM reactors use mixed conducting oxygen permeable ceramic membranes which can simultaneously transport both oxygen ions and electrons without the requirement of an external circuit. One of the potential materials for oxygen permeability is the Lanthanum Nickel Oxide, La_2NiO_4 (LNO), which is known for its high temperature stability. LNO powders are synthesized by sol-gel method from nitrate solutions. These powders are compacted to obtain LNO membranes and characterized using x-ray diffraction (XRD) and scanning electron microscopy (SEM). We have designed and built a gas permeation flux instrument for the oxygen flux measurement. The device is connected to a gas chromatography system. The oxygen flux obtained for 1mm thick membrane at 700°C is 0.06 μmol cm^{-2} s^{-1}. In order to improve the surface catalytic activity of the membrane, the LNO membrane is coated with silver paste. An improvement of about 40 to 45% in the permeation flux is achieved. The study of the temperature effect shows that the permeation flux exponentially increases with the increase of temperature.

Nanocomposite Fibers of PET/CNT: Effect of Post Drawing Temperature on Mechanical Properties

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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 16^{o}C to 100^{o}C. 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 50^{o}C to 70^{o}C. 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 and Costing of a Steam Turbine Power Plant Powered by Solar Tower Technology with Storage for Kingdom of Saudi Arabia

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Abstract

In the face of global warming, with energy policies calling for wide-scale use of renewable and sustainable technologies, solar powered power plants are becoming increasingly valuable in the reduction of fossil fuel energy use. Cost reduction forecasts implicate that CSP plants could be competitive with fossil fuel power stations in the near future. In this study, a steam power plant powered by solar tower with storage has been simulated under the weather conditions of Dhahran, Kingdom of Saudi Arabia. The advantage of using solar tower technology over other CSP technologies (parabolic troughs, Fresnel collector etc) is discussed. High temperature energy from the tower is transferred through heat transfer fluid to generate steam for the steam turbine cycle operation. Since the temperature of steam entering the turbine is high (above 500 o C), a better efficiency of the system is achieved. Furthermore, an analysis will be carried out on the affects of solar multiple, duration of solar storage etc on the costs of the solar field.