*The 8th International Conference on*
*Modeling Simulation and Applied Optimization*
ICMSAO 2019

# Conference Program

| | Monday, April 15 | Tuesday, April 16 | Wednesday, April 17 |
|---|---|---|---|
| 8:30 - 9:00 | *Registration Day-1* | *Registration Day-2* | *Registration Day-3* |
| 9:00 - 9:30 | | | |
| 9:30 - 9:45 | *Opening Speech* | SC1: *Statistical Modeling and Combinatorics*<br>SC2: *Mathematics and Mathematical Modeling*<br>SC3: *Intelligent Systems*<br>SC4: *Manufacturing Systems*<br>SC5: *Structural and Fire Engineering*<br>SC6: *Electrical Engineering 1* | SG1: *Materials and Composites*<br>SG2: *Artificial Intelligence*<br>SG3: *Computer Engineering 2*<br>SG4: *Electrical Engineering 2*<br>SG5: *Mechanical Engineering & Applied Mathematics* |
| 9:45 - 9:50 | *Documentary Video on the University of Bahrain* | | |
| 9:50 - 10:00 | *Sponsor Ceremony* | | |
| 10:00 - 10:20 | P1: *Panel 1* | | |
| 10:20 - 10:40 | | | *Coffee Break* |
| 10:40 - 11:00 | | *Coffee Break* | |
| 11:00 - 11:30 | *Coffee Break* | SD1: *Applied Mathematics 2*<br>SD2: *Logistics and Transportation*<br>SD3: *Robotics and Mechatronic Systems*<br>SD4: *Thermal and fluid systems 1*<br>SD5: *Fuzzy Sets and Systems*<br>SD6: *Electromagnetics* | W1: *Business Analytics*<br>W2: *Supply Chain Optimization*<br>W3: *Quantitative Research Methods*<br>W4: *Financial Modeling* |
| 11:30 - 12:30 | P2: *Panel 2* | | |
| 12:30 - 12:40 | *Networking and Lunch Break-Day1* | | |
| 12:40 - 13:00 | | *Networking and Lunch Break* | *Closing Session and Closing Remarks* |
| 13:00 - 14:00 | | | *Networking and Lunch Break* |
| 14:00 - 15:40 | SA1: *Routing Problems*<br>SA2: *Modeling 1*<br>SA3: *Cloud computing and Big Data*<br>SA4: *Biomedical Signal and Image Processing*<br>SA5: *Civil Engineering*<br>SA6: *Communications and Signal Processing* | SE1: *Applied Mathematics 3*<br>SE2: *Efficiency and Data Envelopment Analysis*<br>SE3: *Soft Computing Theory and Applications*<br>SE4: *Engineering Management*<br>SE5: *Modeling 2*<br>SE6: *Electronics* | |
| 15:40 - 16:00 | *Coffee Break* | *Coffee Break* | |
| 16:00 - 17:40 | SB1: *Applied Mathematics 1*<br>SB2: *Applications of Modelling and Simulation*<br>SB3: *Computer Engineering 1*<br>SB4: *Biomedical systems modeling*<br>SB5: *Chemical Engineering*<br>SB6: *Control Systems* | SF1: *Power Systems and Electric Drives*<br>SF2: *Algorithms for Scientific Computing*<br>SF3: *Thermal and Fluid Systems 2*<br>SF4: *Biomedical and Chemical Engineering*<br>SF5: *Modeling 3*<br>SF6: *Software Systems* | |
| 17:40 - 18:00 | IS: *INFORMS-GCC Section Kickoff meeting* | | |
| 20:00 - 22:00 | *Conference Dinner* | | |

## Monday, April 15 8:30 - 9:30

Registration Day-1

## Monday, April 15 9:30 - 9:45

Opening Speech

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## Monday, April 15 9:50 - 10:00

Sponsor Ceremony

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P1: Panel 1

## Monday, April 15 11:00 - 11:30

Coffee Break

## Monday, April 15 11:30 - 12:30

P2: Panel 2

## Monday, April 15 12:30 - 14:00

Networking and Lunch Break-Day1

## Monday, April 15 14:00 - 15:40

# SA1: Routing Problems

Room: Al Majlis 4th Level

Chair: Chefi Triki (Sultan Qaboos University, Italy)

### SA1.1 14:00 *Safety Evaluation of Intersections in Bahrain*

Uneb Gazder and Ahmed Hasan (University of Bahrain, Bahrain)

Intersections are among the places where highest number of accidents occur, thus, studying their safety and considering countermeasures to increase their safety should improve the overall safety of a traffic system. In this study, we looked into the intersections with the highest reported accidents in the Kingdom of Bahrain through the years 2013-2016 courtesy of the Bahrain General Directorate of Traffic. The intersections with most recurring crashes are singled out and studied in more details, following the procedure of intersection screening detailed in the AASHTO Highway Safety Manual (HSM).

### SA1.2 14:20 *Autonomous Vehicles Delivery Systems Classification: Introducing a TSP with a Moving Depot*

Batool Madani and Malick Ndiaye (American University of Sharjah, United Arab Emirates)

The vast growth in the e-commerce market has increased the attention to resolving the problem of conveying goods from distribution hubs to final destinations (customers) in the supply chain. The process known as the Last Mile Delivery (LMD) problem has significant challenges such as reducing operational cost or ecological impact and increasing supply chain performance. The inclusion of new technologies such as drones, robots, and the internet of things help tackle these challenges by developing new distribution systems to improve from traditional deliveries methods (delivery person, postal/delivery boxes). However, the use of these technologies brings new operational challenges. For instance, in a combined truck-drone delivery system, the truck serves as a depot from where we load the product to the drone for final delivery to the customers. The depot is now moving unlike in a traditional Vehicle Routing Problem (VRP) for which we always assume a fixed depot. This research paper deals with the impact of using Autonomous Vehicles (AV) on the logistics of the LMD. We first present a

technological review of the use of AVs in logistics and use it to introduce a classification of the delivery systems based on the parcel/product handover at the time of the last handling before delivery to customers. We describe three categories of handovers, namely, machine-to-person, machine-to-machine, and person-to-machine, and characterize for each of them the type of vehicle routing optimization that it implies. We present a new class of vehicle routing problems with a moving depot and formulate two variants of a Discrete Traveling Salesman Problem (TSP) with a Moving Depot (TSP-MD). We solve the problem using the General Algebraic Modeling System (GAMS) software.

### SA1.3 14:40 *Using combinatorial auctions for the procurement of occasional drivers in the freight transportation*

Chefi Triki (Sultan Qaboos University, Italy)

Introducing occasional drivers in the context of freight transportation can represent a valuable option in order to face some of the distribution challenges. This paper is concerned with improving the orders delivery by involving occasional drivers to be selected from the public using the combinatorial auctions technique. We propose a mathematical model that is based on integrating the routing of vehicles with the winner determination problem. The objective is to minimize the overall transportation cost due to either the company's own fleet or by external drivers. The validation of the model as well as the advantage of involving occasional drivers have been verified by solving a real case study related to a delivery company installed in Oman.

### SA1.4 15:00 *Probabilistic Modeling for Time-Limit Traveling Salesman Problem Using Simulation*

Mojahid F Saeed Osman (American University of Sharjah, United Arab Emirates)

This paper proposes a model for solving the traveling salesman problem with uncertain travel and service times and service time-limit constraints. The service time required at any customer location is assumed to have a statistical regularity with a particular probability distribution. The objective is to visit and provide services to all customers without surpassing the allowed working times for the salesman. The paper presents a simulation-based probabilistic model that integrates heuristic framework for solving the salesman problem. A case problem is introduced for exemplifying the feasibility and effectiveness of the proposed model for solving the problem addressed in this paper.

### SA1.5 15:20 *Dynamic Car-Passenger Matching based on Tabu Search using Global Optimization with Time Windows*

Marvin Erdmann (BMW AG & Bundeswehr University Munich, Germany); Florian Dandl and Klaus Bogenberger (Bundeswehr University, Germany)

On-Demand Mobility is an increasingly popular concept especially in urban areas, which has the potential to reduce the space needed by privately owned vehicles. Additionally, congestion and air pollution can be decreased on the long term due to shared car fleets. To avoid a decline of flexibility and convenience for the customers and to minimize the costs for the service provider, a fleet management algorithm matches the requests and the vehicles in order to quickly find a reliable and time efficient solution for the whole system. The focus of this work is to introduce a new approach to find solutions periodically using a Tabu Search metaheuristic, called Global Optimization with Time Windows. It is shown that this method allows significantly better solutions compared to those found by the Nearest Neighbor Policy, without losing the ability to quickly inform customers about their pick-up time.

## SA2: Modeling 1

Room: Al Marsa 4th Level

Chair: Fouad Ben Abdelaziz (NEOMA Business School, France)

### SA2.1 14:00 *A Robust Goal Programming Model For Transfer Pricing Risk Hedging: Preliminary Results*

Marco Repetto (University of Milan-Bicocca, Italy); Davide La Torre (University of Dubai, United Arab Emirates); Danilo Liuzzi (University of Cagliari, Italy)

In the following paper is proposed a model for controlling the Transfer Pricing risk of a Multinational Firm operating in different countries and that has a well-defined value chain spread across its different controlled companies. These types of agreements controlling such transactions generally take into account different type of objectives. Another problem arises by the process itself that may appear to be fairly deterministic; such simplistic assumption decays if the focus is placed on the general length of such agreements that tend to occupy a medium length planning horizon. Because of that, a Robust Multicriteria Transfer Pricing risk model is built, using the multiple objective capabilities of the Goal Programming approach and the uncertainty modeling features provided by the concept of Robust Optimization. The final result is a model in order to handle the possible worst-case scenarios in an environment of high uncertainty and mid to long-term planning.

### SA2.2 14:20 *Multi-objective 3D bin-packing problem*

Jasim Hasan, Jihene Kaabi and Youssef Harrath (University of Bahrain, Bahrain)

This research paper deals with a special case of a multiobjective 3D-Bin Packing Problem. n 3D boxes of different volumetric dimensions are to be filled in a minimum number of identical bins. The boxes have different weights and can be only horizontally rotated when placed in the bins. Two objectives are simultaneously considered: Use the minimum number of bins to pack all the boxes and have balanced bins in term of total weight. TheinvestigatedproblemisNP-hard.A3Dalgorithmisproposed to solve this problem in two main phases. During the first phase, all the possible combinations of layers of same or different types of boxes that can fit in a bin are generated. These combinations represent solution candidates in term of bin's volume. Finally, in the second phase the boxes are packed in the bins according to the best use of the bin's volume from the solutions candidates. This 3D algorithm was validated using real world data from the courier company Fedex and compared with the results of a lower bound and another recently published algorithm. The results showed that the proposed algorithm is much better in both criteria.

### SA2.3 14:40 *Ambulance Allocation Models: A Review*

Bilal El Itani and Fouad Ben AbdelAziz (NEOMA Business School, France); Hatem Masri (Sakheer Campus, Bahrain & University of Sousse, Tunisia)

In this paper we provide a review of important ambulance allocation models developed in the last 40 years. These models include both strategic and operational level decisions. The review aims to provide researchers with an easy to-understand, comprehensive and up-to-date summary of deterministic, probabilistic, and dynamic ambulance location models.

### SA2.4 15:00 *A Dynamic programming method to solve the multi-period substitutable resources production-allocation problem*

Mohamed Essalah Salah and Younes Boujelbene (Faculty of Sciences Economics and Management of Sfax, Tunisia)

In this paper, we present a review model of the minimax multi-period substitutable resources allocation problem. We start from the presented model and we formulate a linear programming model of the minimax multi-period substitutable resources production-allocation problem. We develop a resolution method to

solve the formulated model. We present an experimental results of the formulated model and the developed method. The experimental results provide that the developed method is efficient to solve the formulated model.

### SA2.5 15:20 *On the Product Development Times in various Market Properties*

Mahmood Al Kindi (oman); Emad Summad (Sultan Qaboos University, Oman)

In this paper we present a decision analytic to analyze different product development scenarios and obtain the optimal recommendation on the product development time. These scenarios differ in many aspects such as the product complexity level, the competitor's quality level, price demand-sensitivity. The objective to generate managerial insights on how much time should a company spent in the development when theses market characteristics differ. In general, product development time is sensitive to this market and yet the optimal strategy varies.

## SA3: Cloud computing and Big Data

Room: Nadwa 1 5th Level

Chair: Hesham al-Ammal (University of Bahrain, Bahrain)

### SA3.1 14:00 *A Novel Host Readiness Factor used for Energy-Efficient VM Consolidation in Cloud Data Centers*

Salam Ismaeel (Ryerson University, Canada); Ali Miri (Ryerson University & University of Ottowa, Canada); Ayman Al-khazraji (University of Bahrain, Bahrain)

This paper proposes a real-time virtual machine (VM) provisioning framework to minimize energy consumption in a cloud data center with an efficient and novel data pre-processing, real-time clustering, instant multivariate time-series prediction and placement algorithms. This practically developed framework from our previous work, suitable for real-time VM consolidation that takes into consideration user behavior and VM historical usage to forecast number of future VMs to improve the consolidation process with minimum energy used. The proposed real-time framework has been evaluated using different sampling rate and duration from real data. Implementation shows about 80% improvement on average in the performance of the proposed framework.

### SA3.2 14:20 *A Big Data visualization layer meta-model proposition*

Allae Erraissi (Hassan II University & Faculty of Sciences, Morocco); Mouad Banane and Abdessamad Belangour (University Hassan II, Morocco)

The increase in the amount of data to be viewed due to the Big Data phenomenon brings new challenges to the field of information visualization. On the one hand, the amount of information to be represented exceeds the space available on the screen, causing occlusion. On the other hand, this data cannot be stored and processed on a conventional machine. A massive data visualization system must allow scalability of perception and performance. At the level of the Big Data architecture, the visualization layer has a very important role and it is located just above the Data Sources, Ingestion, Hadoop storage and Hadoop Platfrom Management layers for which we have already proposed a meta-modeling. In a continuous effort, we will present in this paper a universal meta-modeling for the visualization layer and its relation with the other layers of a Big Data system.

### SA3.3 14:40 *An Efficient Workload Clustering Framework for Large-Scale Data Centers*

Salam Ismaeel (Ryerson University, Canada); Ayman Al-khazraji (University of Bahrain, Bahrain); Ali Miri (Ryerson University & University of Ottowa, Canada)

Cloud workload refers to the load produced by a large variety of applications and services deployed on cloud infrastructures. Workload characteristics can be defined by Tasks and Virtual Machines (VMs). On the other hand, tasks or VMs scheduling, VMs allocation, workload predictions are important topics which are gaining steadily an increasing attention particularly in the past few years. In all these fields, clustering techniques are usually applied to identify groups of workload components characterized by similar behaviors. In order to attain a correct clustering, the appropriate clustering technique needs to be selected. This choice is vital especially when there are vast choices that provide different results. To address such issue, this paper provides a thoughtful review on clustering categories application in cloud workload clustering. Afterward, it proposes a novel systematic method to select the suitable Tasks or VMs clustering method in large-scale data centers based on clustering purpose, validation indices and results comparison.

### SA3.4 15:00 *Addressing Byzantine Fault Tolerance in Blockchain Technology*

Natasa Zivic, Christoph Ruland and Obaid Ur-Rehman (University of Siegen, Germany)

Blockchain technology is considered to be one of the most thriving future Internet technologies with the potential to have a great impact not only on the technical aspects of our lives but also on the social, economic, juristic, security and on many more aspects. Since the appearance of a Bitcoin as the most popular Blockchain based currency a decade ago, the possibilities and strengths of the Blockchain technology have been investigated a lot. The Blockchain technology has a dozen of use cases in different areas of life, whereby one of the most important is Internet of Things and Internet of Everything. This paper concentrates on the vulnerabilities of Blockchain technology, especially on the problem of Byzantine Fault Tolerance. It is one of the crucial problems of Distributed Ledger Technologies in general. Other vulnerabilities of the Blockchain technology analyzed in this paper include the partition and delay attacks.

### SA3.5 15:20 *Comparison and Appropriate Solutions to Prevent Data/Information from Threats of Cloud Computing, Applied in Green Environments*

Ghossoon AlSadoon (AMA International University & College of Administrative Financial l & Sciences, Bahrain)

Cloud computing security or online storage is an E-business that provides mass storage solutions in return for a periodic set fee. Such services enable individuals to store or upload content over a secure, established network of remote servers hosted on the internet to store, manage, and process data, as an alternative to a local server or a personal computer, to avoid the risk of potential loss of vital information without the need to manually or periodically back up data. Due to the shared nature of the network, the main priority is the privacy and protection of organization data utilizing cloud computing. With an increase of individuals and organizations using cloud services, appropriate cloud security is mandatory to avoid potential in an organization. One of the key challenges in cloud computing is how to protect stored information from threats and maintain a high quality of performance in the cloud computing environment. Several different topics are raised in discussions about cloud computing, such as data, privacy, infected applications, and security. This paper discusses different approaches to protecting information and preventing unauthorized access to data, application of cloud computing to keep data safe data and the environment green.

## SA4: Biomedical Signal and Image Processing

Room: Nadwa 2 5th Level

Chair: Fatema Albalooshi (University of Bahrain, Bahrain)

### SA4.1 14:00 *Clinical Applications and Importance of Conventional to 3D Digital Imaging Techniques in Dentistry: An overview*

Shaikh Mohammed Aamer Saleem (P. hd Student, Dr. B. A. M. University, Aurangabad, India); Ganesh S Sable (MIT BAMU Aurangabad India, India)

With wide spread of technology in medical field, imaging techniques are basic key elements in dentistry. There are different methods and techniques, according to preference by dentists to detect and diagnose dental abnormalities in proper way. Earlier there was classical (film based) method used to detect caries, bone artifacts, periodontal disease etc., now digital radiography technology is using for clinical observation. Digital Imaging has some advantages over film based processing method, but again classical method is preferred by dentist. There are number of diseases pertinent to teeth are identified and diagnose by means of analyzing 2D and or 3D images. These images captured by means of respective machines. Paper focuses on different imaging techniques, dental clinical applications, advantages, disadvantages and comparison of digital imaging. It also shows image processing and different software in dentistry

### SA4.2 14:20 *Finite difference method based super-diffusive model for benign brain tumor segmentation*

Saroj Kumar Chandra (Indian Institute of Information Technology Design and Manufacturing & Jabalpur, India); Manish Bajpai (IIITDM Jabalpur, India)

Brain tumor segmentation in early stage is a complex and challenging task. It involves the process of identifying benign brain tumor cells among normal healthy cells which have approximately similar characteristics. Many methods have been proposed for benign brain tumor segmentation but most of the methods fails to detect such low variation data. In the present manuscript, fractional model for benign brain tumor segmentation is proposed. The model has higher sensitivity towards low differential data due to arbitrary order of derivative. This arbitrary order of derivative has been exploited to segment benign brain tumor. The results obtained have been compared with existing state-of-the-art methods and it has been found that proposed method is superior in benign brain tumor segmentation.

### SA4.3 14:40 *Fractional Anisotropic Diffusion Model for Image Smoothing*

Saroj Kumar Chandra (Indian Institute of Information Technology Design and Manufacturing & Jabalpur, India); Manish Bajpai (IIITDM Jabalpur, India)

Image smoothing is one of the most useful application of image processing. The methods available for image smoothing can be divided into pixel-based and partial differential equation(PDE) based methods. It is found that pixel based methods are able to suppress noise but also blurs out the edges. The PDE-based methods are able trade-off between noise suppression and edge preserving. However, it is found that these methods creates side effects such as blocky effect, speckle effect after processing. The present manuscript presents a fractional partial differential equation (FPDE) based image smoothing model. The model not only reduces the effect of noise but also preserves edges. The qualitative and quantitative comparative evaluation has been done. It has been found that proposed model has higher performance ratio.

### SA4.4 15:00 *Wavelet-based Semblance Analysis of Gait Dynamics in Parkinson's Disease*

Abdul Rahman Khalid Alhaidar (Majmaah University, Saudi Arabia); Mohamed Yacin Sikkandar (Majmaah University & College of Applied Medical Sciences, Saudi Arabia); Abdulaziz Alkathiry (Majmaah University, Saudi Arabia)

Analysis of Parkinson's disease (PD) patient's gait pattern from foots vertical ground reaction forces' (VGRF) is a challenging research problem with significant clinical applications. The aim of the current study is to advance this approach further and investigate relationship of VGRF signals obtained from patients with PD foots as a function of time. Instrumented gait analysis has been widely used in a traditional gait laboratory and there is a lack of understanding gait patterns in different phases of gait cycle. In this study, a modern signal processing method called wavelet-based semblance analysis is performed on time series signals obtained from VGRF sensors placed under the foots of PD patients. Semblance analysis between VGRF signals of PD patients in normal walking and dual tasking shows that it has high cross correlation ($P<0.0001$) than control subjects. Semblance power ration (PRSEM) is always greater than 1 for control subjects and is $\leq$ 1 for subjects with PD. These findings pave way for measuring the degree of similarity of dual tasking gait dynamics of PD patients from a normal walking using simple RBFNN method.

### SA4.5 15:20 *Three-Dimensional Terahertz Medical Imaging Reconstruction using Inverse Scattering Problem*

Abdel-Aziz Hassanin and Amr Saadeldin Shaaban (Menufia University, Egypt); Fathi El-samie (Menoufia University, Egypt)

Terahertz images are of great interest in allowing the image of a biological object to be achieved. The inverse scattering problem of three-dimensional terahertz medical imaging is investigated. Dielectric object of known permittivity is located in situated medium around the object and illuminated by a group of unrelated incident Terahertz waves. The scattered field is received in a plain situated behind the object. The theoretical analysis is based on the principle that the scattered electromagnetic field is function of the volume distribution of equivalent currents inside the biological object. Numerical results are given to demonstrate the capability of the inverse scattered problem algorithm. In order to test this the image of dielectric sphere is obtain from the calculated scattered electromagnetic field. The results of scattered electromagnetic field measurements carried out on different material objects are given. Good reconstruction is obtain from measured data even the results of scattered electromagnetic field measurements carried out on different material objects are given

## SA5: Civil Engineering

Room: Nadwa 3 5th Level

Chair: Farid Abed (American University of Sharjah, United Arab Emirates)

### SA5.1 14:00 *FE Parametric Study of the Compressive Behavior of CFSTs*

Mostafa Elyoussef, Muad Elgriw and Farid Abed (American University of Sharjah, United Arab Emirates)

The aim of this paper is to develop a 3D non-linear finite element model to simulate the behavior of Concrete-Filled Steel Tubes (CFSTs) under compressive loading. The FE model was developed using the commercial software ABAQUS. The proposed FE model was validated by comparing numerical results to their experimental counterparts obtained from previous study. The model was then used to conduct a parametric study that examines the effect of geometric and material properties on the compressive behavior of CFSTs. Compression tests of CFST samples with different (D/t) ratios were simulated in the proposed model. It was found that both axial load capacity and stiffness of CFST decrease with increasing (D/t) ratios. The effect of steel yield strength on the behavior of CFST samples was also investigated using the FE model. The numerical simulation showed that axial load capacity increases as steel yield strength increases.

### SA5.2 14:20 *A Finite Element Model of a UHPC Beam Reinforced with HSS Bars*

Omar Abuodeh and Farid Abed (American University of Sharjah, United Arab Emirates)

This paper presents a three-dimensional nonlinear Finite Element (FE) model of an Ultra-High Performance Concrete (UHPC) beam reinforced with High-Strength Steel bars. The UHPC and HSS mechanical parameters were acquired from experimental tests of two distinct studies. As a result, these parameters were

employed in a commercial FE software, Abaqus, and were able to simulate the nonlinear behavior of UHPC and HSS bars implemented in beams. Afterwards, a parametric study was conducted to investigate the effects of varying the beam's depth on its moment-deflection response, where a polynomial correlation was observed between the depths versus the load capacity of a beam.

### SA5.3 14:40 *Development of Maintenance Program for Main Road Network in Bahrain*

Fatima Nassar (Univirsity of Bahrain, Bahrain)ions are spending millions to develop internal and external road networks because they well understand the great effect of this on the social life of people and economy. Considerable attention is given also to maintain and improve the developed network in order to insure its sustainability and the safety of road users. Kingdome of Bahrain has developed a well-designed road Network. All cities, villages, economic centers, touristic monuments and properties are well connected with a road network consisting of 3780 kilometer of asphalted highways, avenues, major roads and internal roads. There are two different budgets allocated by Ministry of finance for the purpose of maintaining the road network. The first one for main routs i.e. highways and avenues and the second one formajor and internal roads. These budgets must be utilized over two years.

### SA5.4 15:00 *Developing Interaction Diagram for BFRP-RC Short Columns using FEA*

Ahmad Hamze, Rasha Al-Taher, Anas Taji, Dana Yazbak and Farid Abed (American University of Sharjah, United Arab Emirates)

the main aim of this paper is to investigate the behavior of short concrete column reinforced longitudinally with BFRP rebar. The analysis is conducted by developing a nonlinear three-dimensional finite element model using the commercial software ABAQUS. Geometric and material nonlinearities were considered in the FE modeling to simulate the inelastic large deformation of concrete material. The FE model was first validated by comparing its capability to predict the compressive strength with the analytical solution for RC short columns reinforced with conventional steel bars. Concentric and eccentric loading cases were considered for this verification analysis. The validated FE model was then used to develop an interaction diagram for BFRP-RC short columns. Values of axial capacities and moments at different points were used to plot interaction diagrams.

### SA5.5 15:20 *Finite Element Modeling of Single Shear Pullout Specimens and Flexural Prisms*

Kais Douier, Jamal Abdalla and Rami Hawileh (American University of Sharjah, United Arab Emirates); Aktham Samir Alchaar (American University of Sharjah & Advanced Construction Technology Contracting llc, United Arab Emirates)

This paper presents the experimental and numerical investigation of the bond behavior between the carbon fiber reinforced polymer (CFRP) sheets and concrete surface. In this study, two Finite element (FE) models were developed to study the bond behavior using single lap shear test and the flexural prism test. Three-point bending test was conducted for the flexural prism and load-deflection response was recorded until the failure of the specimen. FE models were developed using the multipurpose program ANSYS and the experimental results are used to validate the accuracy of the developed FE models. The results showed that there is good agreement between the FE predicted numerical models and the experimentally measured results until the elastic stage of the loading. The percentage difference between the experimental and numerical results is in the range of 4-9%. Hence, FE models are capable to capture the response of prisms under single lap shear test and flexural prism test with high level of accuracy.

## SA6: Communications and Signal Processing

Room: Nadwa 4 5th Level

Chair: Luisella Balbis (Assistant Prof, Bahrain)

### SA6.1 14:00 *Melting stage diagnostic in diffferent types of electric arc furnaces based on the analysis of the harmonic composition of the electric arc current*

Alexander A Nikolaev, Platon Tulupov and Olga Tulupova (Nosov Magnitogorsk State Technical University, Russia)

The authors of the paper carried out experiments to study the harmonic composition of current for electric arc steel-making furnaces of different classes and power range operating at different steel-making enterprises of Russia. This made it possible to carry out the analysis of changes in the higher harmonics of current of electric steel-making furnaces, find out regularities of changes of certain harmonic components and to determine the average and maximum levels of harmonics for electric arc furnaces of each type. The research group also made the comparative analysis of the rate of change in the total effective values of even and odd harmonic components, which made it possible to find an important regularity that the rate of even harmonic weakening in the electric arc furnace is several times higher than that of odd harmonics. Thus the authors proved the applicability of the root-square-mean value of current of even harmonics for the purpose of diagnostics of heat stages in an arc steel-making furnace using the conventional manufacturing process. This principle formed the basis of the structure of the new control system of electrical mode of the furnace and this new control system makes use of the diagnostic technique of the heat stage by the harmonic composition of the signal of electric arc current.

### SA6.2 14:20 *A comparative study of Different Denoising Techniques in Digital Image Processing*

Kamran Ahmad (Tianjin Polytechnic University, P.R. China)

The quality of image usually depends on various factors including noise, light, and temperature. Noise has a decisive role in the image as it is constantly present in different digital images. Noise implication may present during the image coding, transmission and development process. Noise removal has become an eye-catching and dynamic field in the Image processing domain. There is a significant recent advance in filtering of different kinds of noises for digital image processing. In this paper the problem of de-blurring in the presence of various noises is studied. A comparison among various filtering techniques is made in the presence of different kinds of noises. The experiments show that the Adaptive filter method performance is appealing both visually and in terms of objective quality measures that as the color peak-signal-tonoise ratio (CPSNR) and the mean square error (MSE) for Gaussian noise, Speckle noise, Poisson noise, while median filter demonstrates the visual objectives for salt and pepper noise.

### SA6.3 14:40 *Energy Consumption of Data Transfer Over Multiple-Input Multiple-Output Systems*

Jameel Ali (King Saudi University, Saudi Arabia); Majid L Altamimi (King Saud University, Saudi Arabia)

Multiple-input multiple-output (MIMO) technology is a breakthrough that considerably improves the throughput of wireless networks. The ever-growing technology has improved the smartphones to meet the requirements of current IEEE standards for wireless local area networks (WLANs). However, the benefits of smartphones are always constrained by their battery life. This study investigates the energy consumed by a smartphone during the transmission and reception of data. The effect of the different features of 802.11n (including Modulation and Coding Scheme (MCS) and MIMO) is investigated in terms of throughput and energy consumption using a network simulator (NS3). Additionally, the energy consumption during the process of transmission and reception is compared by using per-bit energy consumption for data transfer with different MIMO configurations and physical data rates. The results show that increasing the system configuration beyond 2×2 MIMO improves the throughput and reduce the energy consumption. In addition, a simple energy consumption model is developed for transmission and reception based on MIMO parameter.

### SA6.4 15:00 *Performance Analysis of Cooperative Diversity in Multi-user Environments*

Waled Gheth (Manchester Metropolitan University, United Kingdom (Great Britain)); Abdurrahman M A Alfitouri (Engineering Academy Tajoura, Libya); Khaled M. Rabie and Bamidele Adebisi (Manchester Metropolitan University, United Kingdom (Great Britain)); Khairi A. Hamdi (University of Manchester, United Kingdom (Great Britain))

This paper studies the performance of cooperative multi-relay networks with random numbers of accessing users. A cooperative diversity is achieved at the destination nodes by receiving multiple independent copies of the same signal from M relays when all relays participate in the second phase of data transmission. Accurate analytical expressions are developed for the overall capacity in the collaborative scenarios. The effect of some system parameters on the performance of the proposed system is investigated. Monte Carlo simulations are used to validate the analytical results. The results showed that the performance of the proposed system is positively effected by increasing the number of relays on the network. It also was shown that the performance improves when the number of users increases until the users number becomes close to the number of relays then the performance starts to decrease.

**SA6.5 15:20** ***Economic Model Predictive Control for Irrigation Systems-***

Luisella Balbis (Assistant Prof, Bahrain)

-In this paper, we present a watering system based on Economic Model Predictive Control (EMPC) that anticipates the water demand of the crop, and maintains an optimal soil moisture while reducing water consumption. The algorithm relies on a model of the soil moisture incorporating variables such soil evapotranspiration and deep percolation. This model, that was developed based on climatological data of the Kingdom of Bahrain, is formulated as a linear stochastic state space model. Simulation studies demonstrate the potential of the proposed model and algorithm. Compared to traditional operation of on-off automated irrigation systems based on sensors, the optimized EMPC operating strategy leads to significant saving in water consumption approximately around 10-15%, while maintaining an optimal soil moisture level.

# Monday, April 15 15:40 - 16:00

## Coffee Break

# Monday, April 15 16:00 - 17:40

## SB1: Applied Mathematics 1

Room: Al Majlis 4th Level

Chair: Davide La Torre (University of Dubai, United Arab Emirates)

**SB1.1 16:00** ***Pricing European Spread Call Options Under the Constant Elasticity of Variance with Time-Dependent Volatility Model***

Mohammed Aba Oud (Al Imam Mohammad Ibn Saud Islamic University, Saudi Arabia)

In this paper, we focus on the pricing of European spread call options. In particular, we consider univariate modelling by proposing constant elasticity of variance with time dependent volatility model and derive new analytic approximation formula in the form of asymptotic expansions.

**SB1.2 16:20** ***Stochastic Logistic Shocks and Economic Growth***

Davide La Torre (University of Dubai, United Arab Emirates); Danilo Liuzzi (University of Cagliari, Italy); Simone Marsiglio (University of Pisa, Italy)

We present an alternative to the geometric Brownian motion in order to model random shocks in economics, by focusing on the stochastic logistic process, which is a natural generalization of the geometric Brownian motion. We describe some potential applications in economic growth, and show that its degree of tractability is very similar to that of the geometric Brownian motion, and thus its use can effectively improve the limits (related to the presence of a constant drift) of the geometric Brownian motion to model uncertainty.

**SB1.3 16:40** ***Super Oriented Cycles in Permutations***

Bhadrachalam Chitturi (Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Amritapuri); Jayakumar P (Amrita School of Engineering, Amritapuri Campus, India)

Permutation models a genome. Transposition models the corresponding genomic mutation and nature is presumed to be parsimonious. Thus, transforming a given permutation \pi into another permutation \delta with the minimum number of transpositions corresponds to the transposition based evolutionary distance between the genomes that they denote. This problem reduces to sorting \gamma in minimum moves, that is related to \pi and \delta. That is, computation of td(\gamma). However,computing td(\gamma) is a known intractable combinatorial optimization problem. It has applications in comparative genomics and computer interconnection networks. Bafna and Pevzner designed a 1.5 approximation algorithm using a graph structure called the cycle graph. In a cycle graph, a 0-move does not change the number of odd cycles whereas a 2-move increases the number of odd cycles by two. They showed that two valid 2-moves are possible for every execution of a 0-move. Christie called an odd cycle in a cycle graph as super oriented if it admits a valid 2-move and at least one of the resultant cycle admits a second valid 2-move. He posed an open problem of characterizing super oriented cycles and observed that such a characterization could potentially improve the approximation ratio. We characterize super oriented cycles; thereby completing the characterization of all permutations that admit two consecutive 2-moves when at most two cycles are acted upon. In certain cases, we show that in computing td(\pi), our characterization leads to an improvement in the approximation ratio.

**SB1.4 17:00** ***Estimation of Gas Generation Rate from Municipal Landfill Site in Bahrain***

Majeed S. Jassim (University of Bahrain, Bahrain); Gulnur Coskuner (Royal University for Women, Bahrain); Nauman Nazeer and Galbokka H. Damindra (University of Bahrain, Bahrain)

Anaerobic decomposition of organic compounds in landfills generates greenhouse gases (GHG). The objective of this study is to estimate total landfill gases (LFG) emissions from Asker Landfill in Bahrain utilizing LandGEM software. Total annual municipal solid waste disposal rate between 1997 and 2016 shows considerable increase. The methane generation rate (k) was computed as 0.012 year-1 based on the annual average precipitation data. The potential methane generation capacity (L0) was calculated as 54.26 m3/Mg from the municipal waste composition data disposed to landfill. Annual volumetric and mass LFG generation rates of methane, carbon dioxide and non-methane organic compounds were estimated. Our results showed that LFG emissions might have environmental and health impacts as currently there is no biogas collection system at Asker Landfill site.

**SB1.5 17:20** ***Measuring the Internationalization of Italian Universities using a Network Approach based on Co-Authorship: A Preliminary Analysis***

Michael Ghisletti (University of Venice, Italy); Davide La Torre (University of Dubai, United Arab Emirates); Cinzia Colapinto (University of Venice, Italy)

This paper evaluates connections across universities with a novel approach. A measure of internationalization for sample of Italian Universities is established, by considering how many collaborations scholars from a University have with other institutions. In addition, the ratio between total number of co-authorship and students is analyzed. Centrality indexes and patterns in different geographical areas are provided to enrich the analysis.

# SB2: Applications of Modelling and Simulation

Room: Al Marsa 4th Level

Chairs: Abdelmohsen Desoky (University of Bahrain, Bahrain), Elsayed Elamir (University of Bahrain, Bahrain)

**SB2.1 16:00** ***Modeling and Optimization of the Shape of an Opening Guide***

Florian Zehetbauer, Johannes Edelmann and Manfred Plöchl (TU Wien, Austria); Georg Kalss (FHW Franz Haas Waffelmaschinen GmbH, Austria)

The opening and closing procedure of baking tongs is governed by the shape of the opening guide and is an essential part of the baking process at automatic baking lines to guarantee for high-quality wafer products. To study the dynamic properties of the system related to the shape of the opening guide, a mechanical model is presented in this paper. Considering both procedural requirements and mechanical design to allow for reliable, long-lasting operation of the system, an approach to optimize the shape of the opening guide is introduced. Measurements on a reference system demonstrate the capabilities of the derived framework.

**SB2.2 16:20** ***Numerical Modeling of Nanofluids Flow and Heat Transfer in a Porous Cavity***

Mohamed F. El-Amin (Effat University, Saudi Arabia)

The present article investigates the effect of nanofluid flow with heat transfer in a porous cavity. The model consists of the conservation laws of energy, momentum, and mass. The cavity boundaries are modeled by mixed Dirichlet-Neumann boundary conditions. A multiscale time-splitting implicit method has been used to treat the temporal discretization of the governing equations. The momentum equation which is represented by Darcy's law has been solved with the continuity equation to give the pressure implicitly, then the velocity of the field has been calculated explicitly. Therefore, both energy equation is solved implicitly. The Courant-Friedrichs-Lewy condition has been used to achieve the time step-size adaptation. Two numerical cases are considered for different boundary conditions. Effects of the nanofluid volume fraction on temperature, velocity, pressure and Nusselt number have been studied and the results are represented in graphs.

**SB2.3 16:40** ***Measuring Tone Disclosure as a Complementary Approach: The Case of the Banking Sector at Bahrain Bourse***

Elsayed Elamir (University of Bahrain, Bahrain); Gehan Abdel-hady Mousa (University of Bahrain, Bahrain & College of Business Administration, Egypt)

The aim of this study is to propose four behavioral measures of corporate tone disclosure based on emotion analysis of corporate annual reports using the banking sector listed on the Bahrain Bourse from 2007-2017. Our final data set consists of 88 bank-year observations. The suggested tone disclosure measures are (trust & disgust), (joy & sadness), (anticipation & surprise) and (fear & anger). The proposed measures quantify the integrity; enthusiastic; precognitive and anxiety behaviors of top management. The study found that the integrity behavior of top management is associated with its precognitive behavior while the relationship between the enthusiastic and anxiety behaviors do exist. The current study argues that tone disclosure in corporate annual reports can be a valuable tool to stakeholders because it can reflect the behavior of top management, which may affect actions towards corporate financial reporting. The study suggests using the proposed tone measures as a complementary or diagnostic approach rather than an alternative to the different approaches used by analysts, auditors and other users of financial reports.

**SB2.4 17:00** ***Standard Propagation Model Calibration for Path Loss Prediction in Cellular Networks Using Metaheuristic Optimization Techniques***

Naima Mezhoud (University of Constantine & University of Bejaia, Algeria); Mourad Oussalah (University of Oulu, Finland); Zoheir Hammoudi (SISCOM' Lab, Département Electronique, University of Constantine, Algeria); Abdelouahab Zaatri (University of Constantine 1, Algeria)

In cellular networks, planning and modeling the radio propagation loss is an important task. The Standard Propagation Model is the most used empirical model for path loss prediction in the cellular networks. Therefore, tuning its optimal parameters values is a difficult calibration problem mainly when the drive tests data set are limited. The drive test stage is first carried out in order to collect signal strength measurements data in the considered geographic area. In this paper, we aim to reach a good calibration accuracy of the Standard propagation model, by using a metaheuristic optimization technique preceded by the inverse distance weighting technique stage. The results show that the proposed methodology provides a high calibration accuracy of the standard propagation model for the cellular network.

**SB2.5 17:20** ***Modeling the Dipolar Interaction Field distributions in Random Superparamagnetic System***

Jawad Alsaei, Mohamed El-Hilo and Layla Nasser (University of Bahrain, Bahrain)

Dipolar interactions in a system of superparamagnetic nanoparticles play an important role in the magnetic response of the system, where it is well known that they depress the magnetization. In this study, we simulate a system of 5000 interacting nanoparticles using Metropolis Monte Carlo method. In such system, it is known that the dipolar interactions adopt gaussian distribution with approximately zero mean and with varying standard deviation depending on the applied field and the packing density. In this study we comprehensively investigate the effect of the packing density on the standard deviation of the interaction fields at different applied fields. We provide an empirical formula that combines the two factors and show that it results in magnetisation curves that are in a very good agreement to actual Monte Carlo simulations. Furthermore, we investigate the individual effects of the interaction fields along each direction. While the effect longitudinal components (those that are parallel to the applied field) are well known, the transverse components (that are perpendicular to the applied field) are poorly understood. In this study, we use our developed empirical formula to investigate the effects of the transverse interaction fields on the overall magnetic response. Our results suggest that the reduction in magnetisation due to the longitudinal components is, to a first order approximation, directly proportional to the curvature of the magnetisation curve of the noninteracting system. However, the reduction due to the transverse components does not show this behaviour. In addition, our results show that the longitudinal and the transverse components do not contribute linearly to the overall depression of magnetisation (i.e., the sum of the individual reductions in magnetisation of each component does not add up to the total reduction due to the combined effect of all components).

# SB3: Computer Engineering 1

Room: Nadwa 1 5th Level

Chair: Mazen Ali (University of Bahrain, Bahrain)

### SB3.1 16:00 *Evaluation of SQL Injection Prevention Methods*

Jasim Hasan (University of Bahrain, Bahrain); Ahmed M. Zeki (University of Bahrian & College of IT, Bahrain); Aysha Khaled Alharam and Nuha Al-Mashhur (University of Bahrain, Bahrain)

In the last few years, the usage and dependency on web applications and websites has significantly increased across a number of different areas such as online banking, shopping, financial transactions etc. amongst the several other areas. This has even directly multiplied the threat of SQL injection issue. A number of past studies have suggested that SQL injection should be handled as effectively as possible in order to avoid long term threats and dangers. This paper in specific attempts to discuss and evaluate some of the main SQL injection prevention methods.

### SB3.2 16:20 *Noise Reduction with Dynamic Fuzzy Cognitive Maps in Image Processing*

Turan Altundogan (Cbü Muradiye Kampüsü, Müh. Fak., Bilgisayar Müh. C Blok & Celal Bayar Üniversitesi, Turkey); Mehmet Karakose (Firat University, Turkey)

Noise is a generic term for data loss or corruption due to hardware or software causes on the signal. Since the images are two-dimensional signals, there are noises in this type of signal due different reasons. In addition, fuzzy cognitive maps (FCM) have a structure based on a graph theory that can produce many probing solutions today. Fuzzy cognitive maps can provide their iterations as static (fixed neighborhood values) or dynamic (variable neighborhood values) depending on the solution which belong to interested problem. In this study, a method is presented using fuzzy cognitive maps for noise reduction in images and mean filter which is a widely used method for noise reduction. The proposed method provide to minimize the loss of data in the noise reduction process with the median filter. In this work, FCM takes noisy and median filtered noisy image masks and accepts each pixel value in these masks as nodes. Then we update the neighborhood weights between these nodes in each iteration. The developed method has been tested according to many scenarios and these scenario differences are discussed and comparative results are given. When these results are examined, it is observed that more efficient results are obtained in the noise reduction process than the operations based on pure filter based solution proposals.

### SB3.3 16:40 *Securing Systems and Software: Current State and Challenges*

Omar Abahussain and Mustafa Hammad (University of Bahrain, Bahrain)

In modern society, security attribute becomes an essential part of designing and developing software systems. This paper presents different aspects related to designing secure systems and software. The aims to show the importance of the security attribute to cover all possible threads and weakness that may exists in the system. Moreover, a model-based study is conducted to measure the impact of security attribute on other quality attributes, such as performance and usability attributes.

### SB3.4 17:00 *Temperature-Aware Task Scheduling for Dark Silicon Many-Core System-on-Chip*

Mohammed Sultan Ahmed Mohammed and Ahlam Al-Dhamari (Universiti Teknologi Malaysia, Malaysia & Hodeidah University, Yemen); Ab Al-Hadi Ab Rahman and Norlina Paraman (Universiti Teknologi Malaysia, Malaysia); Ali A. M. Al-Kubati (University of Bisha, Saudi Arabia & Hodeidah University, Yemen); Muhammad Nadzir Marsono (Universiti Teknologi Malaysia, Malaysia)

Due to the high power density and temperature of future chips, most of the cores in future many-core system-on-chip (MCSoC) will be off or 'dark'. This problem is called dark silicon problem. This paper presents a task scheduling technique for optimizing the MCSoC performance under temperature constraint for dark silicon. The proposed technique uses both task migration and dynamic voltage frequency scaling (DVFS) to optimize many-core system performance, while the system temperature is kept in a safe operating range. Task migration improves system performance and balances heat distribution among cores by moving tasks from active cores to dark cores, while DVFS reduces core speed in case of thermal limit violation. Simulation results show that using both task migration and DVFS techniques reduces peak temperature by 12° C and keeps the average system temperature under the thermal limit, while the execution time increased by 16% compared with 50% when only DVFS technique is used.

### SB3.5 17:20 *Acoustic Simulation in School Architectural Design*

Wael Abdelhameed and Mohammed Al Kuheji (University of Bahrain, Bahrain)

The paper investigates the importance of acoustic simulations, particularly how the acoustic factors should be taken into consideration during the early phases of school design. Acoustic simulation processes through BIM use in the early phases of designing will save time and reduce cost. In school design, acoustic has a vital role in enhancing design outcomes, and in creating an education-encouraging environment. The objective of this paper is to employ acoustic simulations to investigate better solutions for existing school projects. An academic-course projects are used to explore the existing school projects' performance, in terms of the acoustic standards in different spaces: classrooms, halls, etc. A literature review is conducted to cover methods used to achieve acoustic standards in school design. The paper concludes to solid results in order to be applied in future school projects, which would lead economically to save unnecessary cost of insulation materials; functionally to maintain occupants' audio comfort; and environmentally to save natural resources

# SB4: Biomedical systems modeling

Room: Nadwa 2 5th Level

Chair: Sayed Alqallaf (University of Bahrain, Bahrain)

### SB4.1 16:00 *Design of a smart in-sole to model and control the pressure under diabetic patients' feet*

Alanoud Albathi (Imam Abdulrahman bin Faisal University, Saudi Arabia); Arwa AlQahtani (Saudi Arabia & Imam Abdulrahman Bin Faisal University, Saudi Arabia); Haya Alshagawi and Shaikha Almoammer (Imam Abdulrahman bin Faisal University, Saudi Arabia); Ebrahim Al-Fakih (Imam Abdulrahman Ibn Faisal University, Saudi Arabia); Lola El Sahmarany (Imam Abdulrahman Bin Faisal University, Saudi Arabia)

Diabetic foot is one of the crucial concerns for diabetic patients due to the excessive pressure that is produced on their feet. High pressures cause foot ulcers and eventually leads to amputation if not treated properly. Preventative measure should be taken to relieve the pressure from ulcers and reduce the chance of amputations. This paper aims to design an insole that monitors and modulates the pressure under the diabetic feet. The design of the insole allows the monitoring and modulating of the pressure under the whole foot by using pressure sensors and electro-valves. However, the primary objective of the design at this stage is to control the pressure under a single zone of the foot. Also, the insole is designed to fit the patient's case where the size and shape of both feet

are normal. In order to establish the final design two related prototypes are evaluated: the first prototype is the phase of calibration which is composed of pressure sensors to measure the pressure under each zone of the foot. The second prototype is the phase of controlling the pressure under the patient's foot which is composed of a single electro-valve and a pressure sensor that are controlled by a micro-controller. All the tests of pressure distribution will be examined in the standing position and level walking only.

### SB4.2 16:20 *Automated Stance Controlled-Knee-Ankle-Foot Orthosis*

Huda Alotaibi, Leenah Alghola iqah and Wed Abusibil (Imam Abdulrahman bin Faisal University, Saudi Arabia); Gameel Saleh (Imam Abdulrahman Bin Faisal University, Saudi Arabia)

Constraining the knee to full extension for disabled patients during walking solves the body-weight support problem. However, it decreases the gait efficiency and increases the vertical displacement of the body. The proposed design of the automated Stance Controlled Knee-ankle-foot Orthosis (SCKAFO) offers a match to the naturally occurring gait events. This is made possible by utilizing foot contact switches and an angle sensor with a motor and integrating them with the orthosis. The proposed design is aimed at patients with one lower limb muscle weakness. It aims to have faster walking speeds, fewer compensatory motions, and more symmetrical gait patterns. In this paper, we are performing several verification tests to ensure the proper performance of SCKAFO. These tests involve analysis of the orthosis material and electronic components to be used in the near future.

### SB4.3 16:40 *Numerical Modeling and Simulation of a Carotid Artery with Dynamic Growth of Aneurysm*

Ahmed Ayman A Almedhun and Mohamed Yacin Sikkandar (Majmaah University & College of Applied Medical Sciences, Saudi Arabia); Mohsen Bakouri (Majmaah University, Saudi Arabia)

Computational Fluid Dynamics (CFD) based model is proposed in this work to evaluate the effects of wall shear stress (WSS) on Carotid artery bifurcation (CAB) region. This study involves the flow inside a carotid artery with an aneurysm that dynamically grows in size from 10mm to 15mm. The wall shear stress (WSS) and the flow effects during this dynamic process is captured and studied. The studies were conducted assuming the artery to be a rigid wall and WSS estimated at various regions of interest. A normal carotid artery was modelled in a computer aided design software by extracting the CT scan data. An aneurysm of 10mm was incorporated and a user defined function coded to dynamically increase the size of the aneurysm from 10 to 15 mm during several pulse of the flow. The flow simulation was performed using a finite volume numerical technique by solving a set of fluid flow equations. The blood was considered as Non-Newtonian fluid and the flow is laminar. The velocity pulse over time was given as input for both rest and exercise conditions. The results were processed to extract the WSS as well as the flow pattern across three cross-sections. A strong vortex with reduction in WSS with increase in aneurysm was noted. The strong vortex could possibly cause damage to inner walls, thinning it, and thus causing an increase in aneurysm size. A high gradient at the bifurcation region is also seen. This shear may cause cell damage and a reason for arteriosclerosis.

### SB4.4 17:00 *A Full State Feedback Control Method for Ventricular Assist Device*

Mohsen Bakouri and Naif Alghamdi (Majmaah University, Saudi Arabia); Mohamed Yacin Sikkandar (Majmaah University & College of Applied Medical Sciences, Saudi Arabia)

The clinical aspiration for an admitted patient with chronic heart failure is to unload the diseased ventricles using mechanical support, and followed by managing the system until the patient can be weaned when the heart has regained sufficient function. In this work, a validation of control algorithm is carried out in acute simulation studies for heart failure patients associated with cardiac assist devices. The proposed software simulation model simulates during exercise condition with changes in heart rate, cardiac contractility and systemic vascular resistance. The results are numerically observed as large changes in pump pulsatility during postural changes. The rate of change in physiological variables demonstrated that the control algorithm is capable of tracking the reference pump flow with minimal error to prevent suction and over perfusion.

### SB4.5 17:20 *Design and Development of a Smart Glucometer Using Near-Infrared Technology*

Khadeeja Bagais, Sakinah Al-Fahaid and Sarah Al-Marshood (Imam Abdulrahman bin Faisal, Saudi Arabia); Ibraheem Al-Naib (Imam Abdulrahman Bin Faisal University, Saudi Arabia)

Due to the huge increase in the number of the patients diagnosed with diabetes around the world, a new generation of reliable, accurate, and painless blood glucose monitoring techniques are needed to fit the patient comfort. This paper discusses a quite new noninvasive technology that has several beneficial features. Near-infrared (NIR) spectroscopy, which is located in the wavelength region of 730-2500 nm, has become a promising technology for blood glucose measurements. The device will be designed based on NIR technology, wireless connection between the smart glucometer and the healthcare center, and GPS with a software application to locate the patient to prevent any serious consequences. The NIR light is directed into the body and it will be partially absorbed and scattered because of the interaction with body chemicals. So, it detects glucose concentration based on the transmitted light intensity, and how the skin absorbs a specific wavelength of light. We decided to go with the NIR technology since it is more accurate, painless, cost-effective, and applicable. The device consists of both transmitter and receiver located side by side. A transmitter LED1550E is used to emit the light into the skin. An FGA10 receiver is chosen to detect the amount of light after part of it has been absorbed in a specific glucose concentration. A preamplifier is used to make the signal compatible with the noise filter. An amplifier is required to make the signal compatible with the Arduino, which should understand the signal. An LCD display is used to show the final readings. The operation is implemented with a 3.2 V source from the microcontroller. The output voltage of the receiver circuit part corresponds to the amount of glucose molecules present in the blood. Hence, this will enable us to classify the subject as normal, hypoglycemia, or hyperglycemia.

## SB5: Chemical Engineering

Room: Nadwa 3 5th Level

Chair: Mohamed Bin Shams (University of Bahrain, Bahrain)

### SB5.1 16:00 *Batch-Wise Unfolding PCA for Fault Detection and Identification of a continuously operated UF system*

Mohamed Bin Shams and Eman Aldeeb (University of Bahrain, Bahrain); Rand Elshereef (Bayer Berkeley, USA); Sara Rezk (University of Bahrain, Bahrain)

The aim of this work is to design a fault-detection and identification system for an industrial-scale Ultrafiltration process and to propose the adopted methodology to other membrane applications. The model was created using a multivariate batch analysis tool, namely, Unfolded Principal Component analysis (UPCA), which reduces the high dimensionality of the data to facilitate the analysis. Although ultrafiltration system is a continuous process, modelling it as a batch process proved effective in overcoming some limitations of the observation wise unfolding e.g. the high false alarms. In addition, to ensure the practicability of the proposed fault detection scheme, the recently launched AspenTech's Asset Performance Management (APM) suite, namely, Aspen ProMV™ was used for modelling, analysis and virtual online monitoring.

### SB5.2 16:20 *Design and Optimization of Oxytetracycline Determination using Vigna unguiculata subsp. sesquipedalis Extract as Green Reagent by Response Surface Methodology*

Kanyarak Prasertboonyai and Chayut Bunterngchit (King Mongkut's University of Technology North Bangkok, Rayong Campus, Thailand)

In this study, to design and optimize parameters which affect to the efficiency for determination of oxytetracycline. The oxytetracycline assay is based on the complex formed between oxytetracycline and iron(III) contained in Vigna unguiculata subsp. sesquipedalis, yielding a yellow colored complex in an acetate buffer medium (pH 6.0) which gave the maximum absorption at 430 nm using UVVisible spectrophotometry. Parameters related to the efficiency for oxytetracycline determination such as pH, green reagent volume and time of reaction were design and analysis using Response Surface Methodology (RMS) by Box-Behnken design (BBD). Under the optimum conditions, a linear calibration graph was obtained over the range 1.00-30.00 mg L−1 . Limit of detection (LOD, defined as 3σ) and limit of quantification (LOQ, defined as 10σ) were 0.43 and 1.41 mg L-1 , respectively. The relative standard deviation (R.S.D.) of 3.25% for determining 10.00 mg L−1 of oxytetracycline (n=11) are obtained. The recommended method has been applied to the quantitation of oxytetracycline in honey samples. Results obtained were in good recoveries in the range of 86.00-116.10%.

### SB5.3 16:40 *Fluid-Structural Interaction Simulation of Vortices behind a Flexible Vortex Generator*

Sharul Sham Dol (Abu Dhabi University, United Arab Emirates); Chan Hiang Bin (Curtin University Malaysia, Malaysia)

This paper computationally studied the strength of wake structures behind a free-oscillating flexible vortex generator (FVG) by computing the circulation around the FVG using Fluid-Structural Interaction (FSI) simulation of RANS (SST) k-ω model. The amount of circulation found that the vortex generated by the FVG is stronger than those generated by the rigid vortex generator (RVG). This result has demonstrated that the FVG has a better turbulence generation ability compared to the RVG, suggesting improved energy transport for better heat transfer rate or improving aerodynamics performance. In addition, the result of the analysis was used to justify the proposed flow model for stronger turbulence phenomenon. According to the model, the case with greater structural velocity will result in a greater shear or circulation. For this purpose, the structural velocity was computed and the result demonstrates an excellent agreement with the model's prediction. This has further strengthened the reliability of the proposed model.

### SB5.4 17:00 *A Comparative Study of Various Nonlinear Gas Transport Models in Tight Rocks*

Iftikhar Ali (University of Hafr Al-Batin, Saudi Arabia)

Over the past few decades, various nonlinear gas transport models are used to describe the gas flow in tight porous rocks. Different modeling approaches are employed to develop these gas transport models. These approaches include the consideration of various flow regimes that occur in the tight porous rocks, such as viscous, slip, transition and free molecular flow, and the amount of adsorbed gas and free gas present in the reservoir. Different reservoir properties including gas density, gas viscosity, intrinsic permeability, tortuosity, porosity and many compressibility coefficients, are analyzed as pressure independent or pressure dependent. These modeling approaches lead to nonlinear gas transport models which differ in their diffusion terms. We investigate the effects of these diffusion terms on the distribution of pressure in the gas reservoirs. The results show that the better prediction of the pressure distribution in the reservoir is obtained by incorporating the full pressure dependent properties of the reservoir parameters.

### SB5.5 17:20 *Optimizing a methanol reactor in Aspen Plus*

Shaker Haji and Omar Al Deeb (University of Bahrain, Bahrain); Ashraf Hassan (Bahrain Petroleum Company & University of Bahrain, Bahrain)

Using a Langmuir-Hinshelwood-Hougen-Watson kinetics, an industrial methanol reactor in a GCC-based plant was modeled in Aspen Plus®. The model parameters were adjusted to reduce the error as determined by deviation from thermodynamic equilibrium; the average error in composition was reduced by 88% for methanol. The optimization was carried out in four ways, in which flow rates and temperatures were manipulated within their physical limits. The case that was most successful in optimizing the methanol production involved controlling the flow rate and temperature of the main feed to the reactor, as well as those of the quenches. Methanol production increased by 3.99%, which represents a methanol mole percentage of 4.87% at the outlet, compared to the original case at 4.67%.

## SB6: Control Systems

Room: Nadwa 4 5th Level

Chair: Abdulla Alqaddoumi (University of Bahrain, Bahrain)

### SB6.1 16:00 *Design State Space Feedback and Optimal LQR Controllers for Load Frequency in Hydraulic Power System*

Akram Abdurraqeeb and Khalil AlSharabi (King Saud University, Saudi Arabia); Majid Aljalal (king Saud University, Saudi Arabia); Wonsuk Ko (King Saud University, Korea)

In electrical grid all generators work and provide the power to the load. When the load on the generator increases, the speed of generator rotor decreases resulting in a reduction in the frequency of the grid. This work proposes a method to improve the frequency response of a hydro-power system during restoration. Firstly, we presented the state space model for Hydro-power system unit, and discussed the controllability and observability of the system. Next, we designed full state feedback controller and tracking gain to improve the performance of the system and decreasing the effect of the frequency load. Then, we designed the optimal closed-loop controller using Algebraic Riccati Equation. We studied the frequency load effect before and after these designs and trying to decrease this effect. In simulation results, state space feedback controller decreases the average over shoot from 10.73% to 6.5% and the average error from 47.8 to zero. For comparison between the two controllers, LQR optimal controller decreases the settling time to 8 second instead of 11.6 second that is obtained from state space feedback controller. In general, the designed LQR optimal controller provides best performance in terms of overshoot, error, and time.

### SB6.2 16:20 *Negative Imaginary Feedback Control for a 3-DOF helicopter system*

Santosh Kumar Choudhary (Manipal Institute of Technology, India)

This paper investigates a robust controller solution for the position and attitude control problem of $3$ degrees of freedom (DOF) helicopter system. The 3 DOF helicopter model contains open-loop unstable dynamics and faces uncertainty due to coupling between roll angle and travel rate dynamics. The control of such complex aero-dynamical system has been a challenging task for the control community. The model of the elevation, roll and travel rate dynamics is considered as a single-input-single-output linear system. The article adopts a newly developed negative imaginary feedback control concept. This method applies a positive feedback control scheme to obtain the desired attitude (elevation angle, roll angle) and position (travel rate) as the outputs of the helicopter systems and, also guarantee the robust stability and tracking property simultaneously. Numerical simulations are demonstrated to verify the effectiveness of the control scheme. The robust properties of the closed-loop system are proven and simulation results of the paper show that stability and tracking property can be achieved simultaneously.

### SB6.3 16:40 *A Modified Techniques of Transmission System by Static Var Compensation (SVC) for Voltage Control*

Ali M Eltamaly (King Saud University, Saudi Arabia); Abou-Hashema Mustafa El-Sayed and Yehia Sayed Mohamed (Minia University, Egypt); Amer Nasr Abd Elghaffar (Minia, Saudi Arabia & Minia University, Egypt)

Static Var Compensation (SVC) is consists of power electronics circuits, that considered one from the Flexible AC Transmission System (FACTS) devices which is the economic constraints that uses to affect the real network under variation of system operating conditions to maintain voltage levels and to control active and reactive power flows. SVC module is depending on the thyristors for controlling active and reactive power flows for enhancing the voltage system. This paper discusses the optimum voltage control techniques using the SVC module with the transmission line to overcome the drop and the influence factors for the voltage in the power system, the paper discussion illustrates the voltage value for IEEE-9 bus system to shows the difference voltage and the power losses without and with SVC installation with the system. Also, this paper uses the MATLAB/Simulink software to introduce the operation steps for the thyristors at coupling the shunt SVC module with the power system to reach the optimal compensation at the voltage drop in the power system.

### SB6.4 17:00 *Model Reduction of Multivariable Systems by Using New Hybrid Method*

Arvind Kumar Prajapati and Rajendra Prasad (IIT Roorkee Uttarakhand, India)

This paper exhibits the application of new model diminution method to the multi input multi output (MIMO) power system model. This method is a combination of two popular model reduction methods which are balanced realization and Cauer second form. It is used to overcome the problem of balanced realization method such as steady state problem. In this method, the balanced realization method is applied for the evaluation of denominator of the lower order model and the numerator is evaluated by using continued fraction approach. This method guarantees the stability of the reduced system and preservation of steady state response of the complete order model. A standard multivariable power system model is taken from the literature for validating the accuracy and effectiveness of the proposed technique.

### SB6.5 17:20 *Review of Attitude Control Approaches for ADCS Optimization and faults tolerance*

Meryem Bouras and Hassan Berbia (ENSIAS, Mohammed V University in Rabat, Morocco)

Attitude determination and control has been one of the most interesting, challenging and active issues in aerospace domain. The attitude control follows from the need to position the satellite around its center of mass and to point its antennas, sensors and payloads toward a specific area of the Earth. Hence, it can achieve its mission. Regarding this matter, many attitude control approaches have been developed and adopted in literature. Our objective is to optimize the reliability of the Attitude Determination and Control System (ADCS). Therefore, in this paper we briefly introduce what are satellites and nanosatellites, we describe the attitude, the ADCS, we present the different attitude control approaches proposed in the literature and we evaluate these schemes by illuminating their advantages and disadvantages. At the end, we present our proposed architecture with the preferred scheme that suits our objective.

## Monday, April 15 17:40 - 18:00

### IS: INFORMS-GCC Section Kickoff meeting

Chair: Sue Merchant (INFORMS, United Kingdom (Great Britain))

## Monday, April 15 20:00 - 22:00

### Conference Dinner

## Tuesday, April 16

## Tuesday, April 16 8:30 - 9:00

### Registration Day-2

## Tuesday, April 16 9:00 - 10:40

### SC1: Statistical Modeling and Combinatorics

Room: Al Majlis 4th Level

Chair: Eman Khorsheed (University of Bahrain, Bahrain)

#### SC1.1 9:00 $k_n$ – out – of – n*: F System with a Random Number of Units*

Mahmoud Boushaba and Lamia Abada (Ecole Normale Supérieure de Constantine, Algeraia, Algeria)

In this paper, we study a $k_n$ – out – of – n: F System that has a random number of units, where $k_n = n - 1$. The distribution of the number of units is assumed to follow a power series class of distributions which contain well-known distributions such as modified or truncated Poisson, geometric. To obtain optimal policies, optimal number of components and optimal replacement time, values which minimize the mean cost rate are computed. Numerical examples are also given to illustrate our results.

#### SC1.2 9:20 *Women Parliamentarians Impact on Economic Growth: A Cross-Country Analysis Evidence*

Eman Khorsheed (University of Bahrain, Bahrain)

Women constitute half of the global population, and consequently half of the potential creators, talents, and innovators. However, they are still under-represented in national parliaments and other political bodies. In this paper, the relationship between economic growth and the proportion of women candidates in nation parliaments is investigated through a cross-country statistical analysis. Other included predictors are population growth, initial GDP/capita, and foreign direct investment. To obtain a long-term view, panel data of 20 high-income countries are used in the form of averages of twelve years starting 2006. Development indicators in the cross-country data exhibit complex interactions. Advanced Machine-Learning tools are used to uncover and capture the complex relationships. By the aid of these tools, interactions are identified and relationships are constructed in a non-linear fashion. The generated non-linear regression model that best fits the data has a high coefficient of determination that exceeds 0.93. Since the aim of this study is to quantify the relationship between shares of parliamentarian women and economic growth independently, Principle Component Analysis is also employed to unveil the desired link. A

principle component regression based model is developed. The results reveal a positive statistical significant effect at level of 0.05, where a 10% increase in proportion of women parliamentarians may, on average, increase economic growth by 0.306%. This study provides an empirical evidence on the positive political role of women with respect to stimulating economic growth.

### SC1.3 9:40 *Sorting permutations with a transposition tree*

Bhadrachalam Chitturi (Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Amritapuri); Indulekha T S (Amrita Vishwa Vidya Peetham, Amritapuri, Kollam, India)

Transforming permutations with operations has been extensively studied and it has applications in genomic studies and interconnection networks. The set of permutations over an alphabet Sigma having $n$ symbols forms a symmetric group denoted by Sn. A transposition tree, T=VT,ET is a spanning tree over VT. The labels of vertices are given by VT=1, 2, 3,...n. The labels of VT denote the corresponding positions of a permutation pi. We seek to sort pi with T. The number of edges of ET that suffices to sort any pi in Sn is an upper bound. A precise upper bound equals the diameter of the corresponding Cayley graph, i.e. diam(Gamma). However, such bounds are identified only for a few trees. Jerrum showed that, in general, it is intractable to compute the diameter if the number of generators is at least two. We compute a measure delta* that is an upper bound. The cumulative value of delta* for all trees with up to 15 vertices is the tightest known value.

### SC1.4 10:00 *Wigner function of accelerated and non-accelerated Greenberger-Horne-Zeilinger State*

Nasser Metwally (College of Science, University of Bahrain, Bahrain)

The Wigner function's behavior of accelerated and non-accelerated Greenberger-Horne-Zeilinger (GHZ) state is discussed. For the non-accelerated GHZ state, the minimum/maximum peaks of the Wigner function depends on the distribution's angles, where they are displayed regularly at fixed values of the distribution's angles. We show that, for the accelerated GHZ state, the minimum bounds increases as the acceleration increases. The increasing rate depends on the number of accelerated qubits. Due to the positivity/ negativity behavior of the Wigner function, one can use it as an indicators of the presences of the classical/quantum correlations, respectively. The maximum bounds of the quantum and the classical correlations depends on purity of the initial GHZ state. The classical correlation that depicted by the behavior of Wigner function independent of the acceleration, but depends on the degree of its purity

### SC1.5 10:20 *Product market competition and labor investment efficiency*

Sabri Boubaker (Université Paris Est Créteil, France); Viet Anh Dang (University of Manchester, United Kingdom (Great Britain)); Syrine Sassi (Université Paris Est Créteil, France)

In this paper, we analyze the link between product market competition and labor investment efficiency. Using a large panel of U.S. listed firms over the 1998-2017 period, we document that product market competitive pressure leads to higher deviations of actual net hiring from its optimal level predicted by economic fundamentals, i.e., lower labor investment efficiency. This result is consistent with the prediction that, since competition reduces profit margins, it increases concerns over the firm's short-term performance, which in turn leads managers to under-invest in human capital as a way to meet earnings targets. We provide further support for the causal relation between competition and labor investment efficiency by exploiting an exogenous source of variation in product market competition, i.e., large reductions in import tariff rates. Our findings stand up to a battery of robustness checks including the use of alternative variable definitions and additional control variables, and accounting for the effect of other concurrent investments. Furthermore, our additional analysis shows that the role of competition in deteriorating labor investment efficiency is stronger for firms with a higher exposure to competitive pressure, tighter financial constraints, and higher labor adjustment costs.

## SC2: Mathematics and Mathematical Modeling

Room: Al Marsa 4th Level

Chair: Nasser Metwally (College of Science, University of Bahrain, Bahrain)

### SC2.1 9:00 *Using Anesthesia Induction Room Can Reduce The Maximum Completion Time In The Operating Theater*

Marwa Khalfalli (HIGHFI Company, France); Fouad Ben Abdelaziz (NEOMA Business School, France); Verny Jerome (NOEMA Busniss School, France)

We study the impact of the anesthesia induction room on the multi-stage operating theater scheduling. By using the simulation approach, we compare between the scheduling with and without the anesthesia induction room. The obtained results show the superiority of the approach that includes the anesthesia induction room to reduce the maximum completion time within an operating theater.

### SC2.2 9:20 *A Two-Level Method for Image Deblurring Problem*

Shahbaz Ahmad (King Fahd University of Petroleum & Minerals, Saudi Arabia)

Image deblurring model with computationally expensive regularization is used to improve the quality of the deblurred images. These models are very efficient in preserving edges and removing staircase effect and other nice properties. However, the associated Euler-Lagrange equations involve high order derivatives or dense matrices which complicate developing an efficient numerical algorithm. In this research work, we present an efficient and robust Two-Level method to overcome these difficulties. The Two-Level method started by reducing the problem to one small, nonlinear system on image with small number of pixels (Level-I) and one less expensive linear system with large number of pixels (Level-II). So by Two-Level method our results will be effective and less expensive.

### SC2.3 9:40 *Construction of a Polynomial Lyapunov Function*

Hajer Bouzaouache (Université de Tunis El Manar & Laboratoire de Recherche en Automatique LARA de l'ENIT, Tunisia)

In this paper, we propose an algebraic criterion for analyzing the stability of polynomial nonlinear systems. This criterion is established by using the Lyapunov direct method under a specific analytical developments based on the use of the tensor product. An algorithm resuming the steps of the construction is proposed and a polynomial Lyapunov function is derived.

### SC2.4 10:00 *A mathematical model for type 1 diabetes, on the effect of growth hormone*

Hannah Al Ali (Emirates Aviation University & Coventry University, United Arab Emirates); Nora Merabet (Emirates Avation University, United Arab Emirates); Abdesslam Boutayeb (Emirates Aviation University & University Mohamed Ier, United Arab Emirates); Wiam Boutayeb (School of High Engineering Studies, Oujda, United Arab Emirates)

Diabetes mellitus is a metabolic disorder charac- terized by chronic hyperglycemia with disturbances of carbohy- drate, fat and protein metabolism resulting from defect in insulin secretion, insulin action, or both. The three main types of diabetes are: type1 diabetes, type2 diabetes and gestational diabetes. As it is associated to a deficient insulin production, type1 diabetes requires daily administration of insulin accompanied with a strict continuous control of carbohydrate intake in order to ensure a glycemic level similar to that of a person without diabetes. In this paper, a mathematical model governed by ordinary differential

equations is presented to describe interaction between insulin, glucose, free fatty acids and growth hormone in the case of type1 diabetes. Stability analysis is carried out and the dynamics of glucose is illustrated by a simulation using different parameter values.

**SC2.5 10:20 *Dynamical analysis of a fractional order prey-predator model with disease in prey population***

Mahmoud Moustafa, Mohd Mohd Hafiz, Ahmad Izani and Farah Aini Abdullah (Universiti Sains Malaysia, Malaysia)

This paper proposes and analyses a fractional order prey-predator model with disease in prey population. The model describes the relationships between predator and prey where infectious diseases play a crucial role. Certain theoretical aspects related to the solution of the model are investigated. The effects of fractional order and predator's death rate on the stability of the fractional order model are also investigated. Numerical simulations are performed to support our analytical results.

## SC3: Intelligent Systems

Room: Nadwa 1 5th Level

Chair: Nasr Al-Hinai (Sultan Qaboos University, Oman)

**SC3.1 9:00 *Development of Automated Schedule Generator for Nurses in Emergency Department***

Ahmed Mohamed Osman, Nasr Al-Hinai and Sujan Piya (Sultan Qaboos University, Oman)

Nurse scheduling problem is considered as a special case of staff scheduling problem with high level of complexity due to number of constraints and its unique nature. Nurse provides vital service to the patients in a hospital and hospital needs to distribute schedule among nurses on 24 hours a day and 7 days a week basis preventing coverage drawbacks and maximizing fairness. This work presents a developed program that solves the NSP in emergency department. The schedule generated by the developed program is found to be satisfactory in terms of variability of nurse days-off and execution time.

**SC3.2 9:25 *Analyze CSCL Chats To Determining Points Of Convergence And Divergence***

Mohammad Allaymoun (AMA International University, Bahrain); Stefan Trausan-Matu (University Politehnica of Bucharest, Romania)

Computer-Supported Collaborative Learning (CSCL) is one of the most significant achievements leading to improve teaching and learning using information technology, as it seeks to activate the student-centered learning, in which the student is the main focus of the learning process. Chat is considered one of the most important CSCL tools which are used in knowledge transfer and information exchange. In fact, chat is an ideal tool that aims to realize the collaborative principle, which allows individuals to express their ideas and opinions through educational dialogues. We propose a model that is capable of analysing the content of chats semi-automatically, in order to determine the most important threads that were discussed in CSCL sessions. To do this, it mainly relies on Bakhtin's ideas and Trausan-Matu's polyphonic model. Student dialogues are analyzed in order to determine the moments of convergence and divergence in their points of view, additionally to providing results in statistical tables and graphics. By these results, teachers can evaluate the educational dialogues in order to know whether students concur or not in their points of views. By doing so, this will help students in establishing educational strategies that can lead to an educational collaborative dialogue without stress or selfishness.

**SC3.3 9:50 *Personalized Reviews Based on Aspect Analysis and Polarity***

Muhmmad Al-Khiza'ay (Deakin University, Melbourne, Australia)

Before e-commerce site users make a decision to purchase a product, they first of all read the reviews on the sites. Based on the votes which website owners receive from users that read reviews, the site owners choose the best reviews. Nevertheless, it has recently been found that redundant information may be contained in such reviews. Thus, it has been recommended that review selection is made based on coverage (i.e., the number of entity aspects enveloped by the reviewers. This paper focuses on additional improving the topmost review group through the use of customization criteria. This driven by the relevance of product aspects may differ among users, and users prefer to pay attention to the aspects that are more relevant to them. The main aim of this work is to give priority to the individual preferences and sentiments of users in terms of reviews. This is achieved through the selection of a personalized top review set by (PAAM), which covers reviews about aspects that are of more relevance to the user. The effectiveness of the proposed approach on computing PAAM with high-level coverage, top quality, and relevance of the subjects that are of importance to the customer are demonstrated through the experimental evaluation.

**SC3.4 10:15 *Online QoE Prediction Model Based on Stacked Multiclass Incremental Support Vector Machine***

Radhia Elwerghemmi (National Engineering School of Gabes, Tunisia); Maher Heni (Sup'com, Tunisia); Riadh Ksantini (Higher School of Communications of Tunis, Tunisia); Ridha Bouallegue (Innov'COM @ Sup'Com., Tunisia)

This article presents a novel online QoE prediction algorithm, namely, Stacked Incremental Support Vector Machine model (SISVM).

## SC4: Manufacturing Systems

Room: Nadwa 2 5th Level

Chair: Bader Almannai (University of Bahrain, Bahrain)

**SC4.1 9:00 *Optimization of Transportation Collaborative Robots Fleet Size in Flexible Manufacturing Systems***

M'hammed Sahnoun (France & CESI, France); Yiyi Xu (LINEACT Laboratory CESI, France); Fouad Ben Abdelaziz (NEOMA Business School, France); David Baudry (CESI - LINEACT Laboratory, France)

The current economic context is uncertain and highly competitive, where companies seek to reduce their production cost and adapt production systems to market needs. Since consumer behaviour becomes more and more unpredictable within shorter and shorter product lifetime, flexible manufacturing systems are introduced to allow company to adapt their production to the market without changing systems. The inherent painful and repetitive transportation activities are central in such workshop, where all other activities, like production and maintenance, are impacted by the transportation task. Recently, more and more collaborative mobile robots fleet are used to ensure this activity. Therefore, the fleet size is necessary to be optimized to reduce costs while avoiding delays. In this paper, we propose a decision making tool based on a multi-agent simulation to help decision makers to find the optimal robot fleet size of transportation robots.

**SC4.2 9:20 *Distortion Validation of Laser Beam Welded SS316LN Steel Plates***

Harinadh Vemanaboina (VIT University, India); Suresh Akella (Sreyas Institute of Engineering and Technology, India); Ramesh Kumar Buddu (Institute of Plasma Research, India); Edison Gundabattini (VIT, India)

A finite element modeling starts with the heat equation, heat flux input and thermal modeling and the material definition. In this study a laser welding model with heat transfer is defined and analyzed for a 3mm thick SS316LN material, the temperature dependent thermal and structural properties are taken for analysis. The laser has not formed the keyhole, yet lateral conduction forms the weld bead will progress and convection and radiation from the top surface. Modeling of these thermal inputs with symmetric BC's of heat at the fusion zone center was used in modeling ANSYS solid70 element to obtain the Thermal temperature distribution. Sequentially, this thermal load is given as input to the solid45 to obtain the structural distortion. An orthogonal Array of 9 experiments with three levels of Laser Power, Weld speed and Shield gas flow rate were conducted and analyzed. The optimum levels obtained were 2750Watts, 2500 mm/min and 10LPM. The shield gas flow rate was related to the convective heat transfer coefficient, h in the model. Experimental validation of distortion by experiments had within 8% agreement.

### SC4.3 9:40 *The surface temperature prediction on steel-tool steel sliding pairs*

Paul Okonkwo, C (Dhofar University, Salalah, Oman)

This study examines the theoretical and numerical prediction of temperature at the sliding contact surfaces of steel-steel pairs using the pin-on-disc and Archard models. The steel-tool contact pair is important to the tribological and forming community. The results show a good correlation between numerical and theoretical calculation of contact temperature. There was abrupt increase in the contact temperature at the contacting surfaces as the sliding speed was increased beyond 35 mm/s. Localization of high peak temperature at the contact regions of the sliding surfaces observed in this study may be important in the wear mechanism of sliding bodies and wider manufacturing community.

### SC4.4 10:00 *Parametric Optimization of WEDM using MABAC Method*

Ishwer Shivakoti (Sikkim Manipal Institute of Technology, Sikkim Manipal University, India)

Multi criteria optimization of WEDM of D3 die steel is presented in this paper where machining is done with brass wire as electrode. Four input process parameters such as pulse off time, servo voltage, and pulse on time and wire tension were considered during operation. The experiment was conducted and the output variables like cutting speed and surface roughness are evaluated at various parametric combination. Taguchi L16 orthogonal array experimental design was utilized and the result was optimized using MABAC method for minimizing surface roughness value and maximizing cutting speed.

### SC4.5 10:20 *Enhancing the performance of Labyrinth Seal using Fluid structure Interaction (FSI) method*

Naseem Abbas (Chung Ang University, Korea)

Labyrinth Seals are widely used in steam turbines to restrict leakage flow, which directly depict the efficiency of turbo machines. In this study the performance of labyrinth seals is enhanced by changing the material of labyrinth seal using ANSYS workbench. The flow simulation part of fluid structure interaction (FSI) was performed on Fluent which was coupled to transient structural study via system coupling. The results of flow simulation indicate pressure and velocity fields inside the fluid domain. And the results of transient structural simulation show that deformation in labyrinth seal due the action of pressure on the surface of the seal. The deformation in seal results in increase in separation of seal and shaft causing increase in leakage of the turbine system. The increase in separation is more for aluminum as compared to epoxy glass fiber. Thus, glass fiber is more suitable material for labyrinth seal than aluminum alloy 6061.

## SC5: Structural and Fire Engineering

Room: Nadwa 3 5th Level

Chair: Md Shah Alam (University of Bahrain, Bahrain)

### SC5.1 9:00 *Modeling for Shear Strength of FRP-Reinforced Concrete Members using Generalized Regression Neural Network*

Md Shah Alam, Uneb Gazder and Md. Arifuzzaman (University of Bahrain, Bahrain)

Generalized Regression Neural Networks (GRNNs) are advocated by researchers to be used for regression problems where the assumption of linearity cannot be justified. This paper presents the predictions of shear strength of concrete members reinforced with fiber reinforced polymer (FRP) bars using GRNN. The members were reinforced in the longitudinal direction only and there was no transverse reinforcement. A database of 196 test specimens is used to train and test the GRNN model. The results of training and testing set of the database are compared with the experimental results. It was observed that GRNN proves to be an effective tool for the prediction of shear strength of concrete members reinforced with FRP bars without stirrups.

### SC5.2 9:20 *3D-Finite Element Analysis (FEA) of Glass Fiber Reinforced Polymer (GFRP) Reinforced Concrete Members*

Md Shah Alam (University of Bahrain, Bahrain); Amgad Hussein (Memorial University of Newfoundland, Canada)

The available finite element packages are not suitable for modeling GFRP reinforced concrete members due to their different properties. This paper presents the finite element analysis (FEA) for glass fiber reinforced polymer (GFRP) reinforced concrete members using ABAQUS. The purpose of the analysis is to predict their shear capacity. The beams were reinforced in longitudinal direction and there was no transverse reinforcement. The FEA results were compared with the test results of GFRP reinforced beams. The results obtained from FE analysis were analyzed for its load-deflection behavior, crack patterns, ultimate loads; and the FE results were also compared with the test results. The comparison reveals that the model predicts the behavior of shear critical GFRP reinforced concrete beams with reasonable degree of accuracy.

### SC5.3 9:40 *Finite Element Modelling of Aluminum Alloy Plated Beams*

Omar Abuodeh, Mohammed Alrifai, Rami Hawileh and Jamal Abdalla (American University of Sharjah, United Arab Emirates)

This study involves the development of three-dimensional nonlinear Finite Element (FE) models of strengthened Reinforced Concrete (RC) beams with different anchorage systems, obtained from experimental testing. The aim of this investigation was to simulate the flexural behavior of strengthened RC beam, and compare FE and experimental results using load deflection response plots, maximum attained loads, and corresponding deflections. Three FE models were developed including: a reference RC beam, beam externally bonded (EB) with Aluminum Alloy (AA) plate along the soffit of the beam, and another strengthened beam with an AA plate EB to the soffit of the beam and anchored at its ends using Carbon Fiber Reinforced Polymers (CFRP) U-wraps. The developed FE models integrated nonlinear material properties and fundamental constitutive laws. The results obtained from the FE models closely agreed with those obtained from the experiment. Therefore, successful FE modeling has proven to provide great insight on the flexural behavior strengthened RC specimens. The performance of AA plated beams would be used as a valid platform to study the effect of different variables.

### SC5.4 10:00 *Prediction of Compressive Strength of Ultra-High Performance Concrete using SFS and ANN*

Omar Abuodeh, Jamal Abdalla and Rami Hawileh (American University of Sharjah, United Arab Emirates)

This paper presents machine learning algorithms based on back-propagation neural network (BPNN) that employs sequential feature selection (SFS) for predicting the compressive strength of Ultra-High Performance Concrete (UHPC). A database, containing 110 points and eight material constituents, was collected from the literature for the development of models using machine learning techniques. The BPNN and SFS were used interchangeably to identify the relevant features that contributed with the response variable. As a result, the BPNN with the selected features was able to interpret more accurate results (r2 =

0.991) than the model with all the features (r2 = 0.816). It is concluded that the usage of ANN with SFS provided an improvement to the prediction model's accuracy, making it a viable tool for machine learning approaches in civil engineering case studies.

### SC5.5 10:20 *Predicting the Shear Capacity of FRP in Shear Strengthened RC Beams using ANN and NID*

Omar Abuodeh, Jamal Abdalla and Rami Hawileh (American University of Sharjah, United Arab Emirates)

This study aims at the utilization of machine learning techniques in investigating the effect of measured geometric and mechanical properties of shear-strengthened reinforced concrete (RC) beams on the shear capacity of fiber reinforced polymers (FRP). Two complementary machine learning techniques were used; artificial neural network (ANN) and neural interpretation diagram (NID). The input parameters obtained from an experimental database were used to construct an ANN model that was programmatically validated. The validated ANN model was used to generate a NID that visually identifies the input parameters which have a direct association with the shear capacity of FRP. Moreover, two ANN models were developed. The first model consisted of all the independent parameters and the second model contained only the selected independent parameters. As a result, the ANN model with the selected independent parameters yielded predictions that are in close agreement with the experimental results compared to the ANN model with all the independent parameters. Thus, the implementation of machine learning techniques has proven to be an adaptive tool that can be fully expanded to other areas in structural engineering.

## SC6: Electrical Engineering 1

Room: Nadwa 4 5th Level

Chair: Manivanna Boopathi A (Bahrain Training Institute, Bahrain)

### SC6.1 9:00 *PRBS Based Identification and Conditional Control for an Optimal Operation of a Pilot Plant Binary Distillation Column*

Eadala Sarath Yadav (Manipal Academy of Higher Education, India); Thirunavukkarasu Indiran (AB5 Block, MIT & Manipal Institute of Technology, MAHE, India)

Input signal design is a crucial part in data driven based system identification. Input is set to excite in such a way that the effect of output should be larger than those responses caused by sensor noise. Input signal generation should contain amplitude, rate of input change (Frequency), bias and variance. One such signal is Pseudo Random Binary Sequence (PRBS) input signal. This papers deals with the system identification of a binary distillation column with temperature as variable of interest, heater voltage and reflux flow rate as its manipulated inputs. Based on the requirement of manipulated input, conditional switch is assigned such that manipulated inputs (Heater and Reflux) switches as a function of error. It is observed that this approach improves the system performance and reduces the operational cost. Result depicts the efficiency of the methodology and control loop structure.

### SC6.2 9:20 *Robust Tracking Control of Micro/Nanopositioning Stage with High Frequency Vibrations*

Mahmoud Al Ahmad Ali, Irfan Ahmad and Hammed Olabisi Omotoso (King Saud University, Saudi Arabia)

To achieve ultrahigh nanoscale positioning precision for a wide band reference trajectory, there is a need to compensate for high frequency vibrations in micro/nanopositioning stages. In this article, an advanced robust control design is proposed to deal with high frequency vibrations in order to achieve precise reference tracking. First, the mathematical model of the considered micro/nanopositioning stage has been achieved from the real-time experimental data. Then, an advanced robust controller has been designed. The simulation results with advanced robust controller are compared with the classical proportional integral controller which is generally used for the similar system. The achieved simulation results verify the superiority of the proposed control scheme in improving the tracking precision for a high bandwidth reference tracking. Compared to classical control results, the proposed control strategy has reduced the tracking error by 58.43% for tracking frequency of 10 Hz and by 72.71% for the tracking frequency of 100 Hz.

### SC6.3 9:40 *Fractional Nonlinear Synergetic Control for Three Phase Inverter Tied to PV System*

Abdelbasset Mehiri, M. Bettayeb and Abdul-Kadir Hamid (University of Sharjah, United Arab Emirates)

This paper proposes a current control strategy for three phase voltage source inverter grid connected PV system. The main objective of the proposed controller is to inject the sinusoidal currents to the grid with lower THD percentage even with the environmental changes which affect the PV array output power. In addition to that, the work done by the authors in[8] which was based on the proposed controller in this paper, but to regulate the dc-link voltage of the inverter, while in this paper we are controlling the currents and voltages injected to the grid. The validation of the proposed controller has been done using the Matlab/Simulink environment, also a comparison with integer nonlinear synergetic control (NSC), sliding mode control (SMC) and proportional (PI) control is done to show the outperformance of the proposed controller.

### SC6.4 10:00 *A Recursive Optimization Algorithm for a surveillance of a convex area*

Ali Maarouf (king Saud University, Saudi Arabia); Wonsuk Ko (King Saud University, Korea); Adnan Nouh (King Saud University, Saudi Arabia)

In this paper, the problem of optimal coverage of an area using a swarm of UAVs for aerial surveillance purposes was discussed. Each UAV is equipped with downward facing camera. A recursive optimization algorithm has been developed to find the minimum number of UAVs along with their placement while maximizing the coverage-quality criterion and percentage of the covered surveilled area. Finally, numerical results are provided to assess the proposed algorithm.

### SC6.5 10:20 *Direct Active Fuzzy Non-Linear Controller for Pressure Regulation in PEM Fuel Cell*

Mohamed Ali EA (National College of Engineering, India); Manivanna Boopathi A (Bahrain Training Institute, Bahrain); Abudhahir A (Veltech MultiTech DrRangarajan DrSakunthala Engineering College, India); Subha Velappan (Manonmaniam Sundaranar University & Tirunelveli, Tamilnadu, India)

In this paper, a control-oriented MIMO dynamic state space model with Direct Active Fuzzy Non-linear Controller (DAFNLC) is designed to control the partial pressure of the reactants in Proton Exchange Membrane Fuel Cell (PEMFC). State feedback controller with integral controller is employed as a non-linear Controller. The gain value of state feedback controller and integral controller are selected by fuzzy logic technique. In fact, the performance of PEMFC is deteriorated by the depleted supply of reactants on both sides. Moreover, the deviation in partial pressure of the reactants across the Proton Exchange Membrane (PEM) damages the membrane on more pressure side and also reduces the life of the PEMFC. Hence, the selection of proper controller plays a major role to enhance the performance and longevity of PEMFC. The main objective of this work is to analyze the performance of the PEMFC under static and dynamic load changing condition to maintain the partial pressure of reactants at set point 3atm. The proposed DAFNLC controls the partial pressure of hydrogen at anode chamber and the partial pressure of the oxygen at cathode chamber by regulating the mass flow rate of hydrogen and oxygen respectively. The simulation test results reveal that the proposed DAFNLC exhibits better performance than the conventional PI controller and Non-linear Controller reported in literature.

# Tuesday, April 16 10:40 - 11:00

## Coffee Break

# Tuesday, April 16 11:00 - 12:40

## SD1: Applied Mathematics 2

Room: Al Majlis 4th Level

Chair: Hana Sulieman (American University of Sharjah, United Arab Emirates)

**SD1.1 11:00** ***Modeling and Simulation of Symmetric Diffusion***

Mostafa Zahri (Sharjah & University of Sharjah, United Arab Emirates)

In this paper, we solve evolutionary partial differential equations for simulating symmetric diffusion. By means of domain decomposition method, we numerically solve and computationally analyze the advection diffusion problem. We combine the domain decomposition method for the time-space integration and a barycentric interpolation method for approximating interface solutions. The solution is carried out as piecewise function on all subdomains and the interface ones. Finally, different types of symmetric diffusions are simulated.

**SD1.2 11:20** ***Riccati equation based controller computation for negative imaginary systems***

Santosh Kumar Choudhary (Manipal Institute of Technology, India)

This article studies an algebraic Riccati equation based a simple systematic controller computation method to achieve stability in the negative imaginary feedback systems. The paper first describes some self-explanatory fundamentals of negative imaginary systems and then the methodology of controller computation for negative imaginary systems is briefly illustrated. To show the effectiveness of the computation method, simulation analysis for an illustrative example is presented.

**SD1.3 11:40** ***Modelling of adsorption of Ni atoms on nano-sheets***

Mansoor Alshehri (King Saud University, Saudi Arabia)

The discovery of graphene sheet has opened up many important technical applications in different fields. In this project, mathematical modelling has been adopted to determine the interaction between nickel atoms and a graphene nanosheet. The binding energies between nickel atoms and a graphene nanosheet is determined using the 6-12 Lennard-Jones potential function together with the continuous approximation. Our results indicate that a minimum binding energy is obtained when the nickel is at a perpendicular distance of approximately $\xi = 2.2$ A above the graphene nanosheet surface corresponding to the adsorption energy of $E \approx 0.14$ (eV). These results can serve as guidance for further work in nanomagnetic applications and other fields of nanotechnology.

**SD1.4 12:00** ***Qualitative behavior of fourth-order neutral functional differential equations***

Omar Bazighifan (Hadhramout University, Yemen); Faisal Al-Showaikh (University of Bahrain, Bahrain)

In this work, new sufficient conditions for oscillation of fourth-order neutral functional differential equation with a continuously distributed delay are established. New oscillation criteria are obtained by employing a refinement of the generalized Riccati transformations. Recently, there has been increasing interest related to the theory of delay differential equations (DDEs), this has been attributed to the important of understanding of application in delay differential equations. Recent applications that include delay differential equations continue to appear with increasing frequency in the modeling of diverse phenomena in physics, biology, ecology, and physiology. One objective of our paper is to further simplify and complement some well-known results which were published recently in the literature. An illustrative example is included.

**SD1.5 12:20** ***Influence of multiple re-infections in tuberculosis transmission dynamics: A Mathematical Approach***

Dhiraj Kumar Das (Indian Institute of Engineering Science and Technology, Shibpur, India); Subhas Khajanchi (Presidency University, India); Tapan Kumar Kar (Indian Institute of Engineering Science and Technology, Shibpur, India)

This investigation accounts a TB transmission model incorporating the possibility of exogenous re-infections and recurrent TB. The qualitative characteristic of the model system has been analyzed covering stability of existing equilibrium points and bifurcation criteria. The expression for basic reproduction number has been obtained using next-generation matrix method. It has been observed that the system performs a backward bifurcation at $R_0 = 1$ and hence $R_0 < 1$ is not sufficient to eradicate the disease. Several numerical simulations have been performed to support the analytical findings.

## SD2: Logistics and Transportation

Room: Al Marsa 4th Level

Chair: M'hammed Sahnoun (France & CESI, France)

**SD2.1 11:00** ***Factors Affecting Same Day Delivery in the UAE***

Mohammad Alsibaei and Salah Haridy (University of Sharjah, United Arab Emirates); M. Affan Badar (Indiana State University, USA)

Numerous factors affect same day delivery (SDD) in E-Commerce. A Delphi survey was designed and sent to industry experts to rate affecting factors based on their respective importance pertaining to SDD in the UAE. The results revealed that the most important factors that affect SDD substantially are: logistics strategy, operations management, IT infrastructure and facility location.

**SD2.2 11:20** ***Modeling the scheduling of a multi products pipeline: A case study in Algeria***

Wassila Abdellaoui and Mehdi Souier (Manufacturing Engineering Laboratory of Tlemcen (MELT), Algeria); M'hammed Sahnoun (France & CESI, France)

The scheduling of the supply chain of the oil industry plays an important role for both international and national industrials sectors in order to provide oil products having a great place in the daily life of the individual and factories. Further, the unavailability of these products may lead to the cessation of activity

and significant cost losses. In such circumstances, the scheduling of multiproduct pipeline problem becomes an attractive research area in the optimization framework of these supply chains.This paper deals with the operational scheduling of multi product pipeline to minimize the operational cost. The system under studyrepresents real-world case study in Algeria and contains one refinery, multi centres. Formodeling this problem, a mixed integer linear programming(MILP)continuous formulation is proposed in a horizon of one month divided in multiple periods with different demands.

**SD2.3 11:40** ***Packaged Bio-Waste Management Simulation Model Application: Normandy Region, France***

Yiyi Xu (LINEACT Laboratory CESI, France); M'hammed Sahnoun (France & CESI, France); Merouane Mazar (LINEACT Laboratory CESI, France); Fouad Ben Abdelaziz (NEOMA Business School, France); Anne Louis (IRISE-CESI, France)

With rapid technological development, population growth and urbanization, nations and governments are forced to face the increasingly large quantities of urban waste generation. Meanwhile, recycling and utilization of solid waste to regenerate energy, save natural resources and reduce air and waster pollution have become a big concern to the whole world. This paper describes a multi-agent simulation model of biodegradable waste management in Normandy region. Several agents are developed to present collection, transportation and treatment processes. Based on data collected from local companies, the model can give useful statistical information about the system performance, like time consuming and transportation cost, and also provide routing, scheduling and pricing strategies for the future management.

**SD2.4 12:00** ***The Effect of Demand Variability on Supply Chain Performance***

Suzan Alaswad, Sinan Salman, Arwa AlHashmi, Hawra AlMarzooqi and Meera AlHammadi (Zayed University, United Arab Emirates)

This paper studies the impact of demand variability on supply chain performance which is measured in terms of operational costs, customer satisfaction, and environmental footprint. The operations within the supply chain have been simulated using a supply chain game simulator. The simulation results show that demand variability has a negative impact on all three supply chain performance metrics but mostly on the operational cost. The results also show that there is a significant increase in performance measurements variability with the increase of demand variability. The results provide managers with insights for planning and improving supply chain performance.

**SD2.5 12:20** ***Genetic Algorithm for a Stochastic Programming Model of the Green Household Waste Transportation Problem***

Haifa Jammeli (ISG TUNIS, Tunisia); Hatem Masri (Sakheer Campus, Bahrain & University of Sousse, Tunisia); Majdi Argoubi (University of Sousse, Tunisia)

The main objective of this paper is to develop a new model for the Green Household Waste Transportation Problem in the city of Sousse, in which several vehicles located at the depot are used to collect waste from many bins and bring them back to the depot. The suggested model is a mono-objective stochastic program that minimizes transportation cost subject to some technical, economical and ecological constraints. To solve this issue, we used genetic algorithm for the certainty equivalent program. A real case study is applied for the municipality of Sousse

## SD3: Robotics and Mechatronic Systems

Room: Nadwa 1 5th Level

Chair: Nabil Hewahi (UOB, Bahrain)

**SD3.1 11:00** ***Adaptive Fuzzy Gain Scheduling Sliding Mode Control for quadrotor UAV systems***

Ahmed Eltayeb Ahmed Taha (UTM University, Malaysia); Mohd Fua'ad Rahmat (Universiti Teknologi Malaysia, Malaysia); Mohammed Ahmed Mohammed Eltoum Mohammed Ali (King Fahd University, Saudi Arabia); Mohd Ariffanan Mohd Basri (Universiti Teknologi Malaysia, Malaysia)

The quadrotor unmanned aerial vehicles (UAV) systems have been getting recently more focus from researchers and engineers due to its outstanding impact and broad applications in civilian and military sectors. The quadrotor dynamic model has been introduced. This research aims to reduce the chattering associated with the conventional sliding mode control (SMC), by applying the adaptive fuzzy gain scheduling SMC technique (AFGS-SMC). Firstly, the AFGS-SMC controller has been designed to control the attitude of the quadrotor as the inner loop controller. Secondly, PD controller has been implemented as an outer loop controller to control the quadrotor position. Finally, the performance of the proposed AFGS-SMC controller has been evaluated by simulation Matlab/Simulink, and compared with the conventional SMC, in terms of chattering attenuation and trajectory tracking.

**SD3.2 11:20** ***Design and Implementation an Indoor Robot Localization System Using Minimum Bounded Circle Algorithm***

Israa Sabri Abdulameer AL-Forati (University of Basrah & Basrah Iraq, Iraq); Abdulmuttalib Rashid (University of Basrah, Iraq)

A new positioning system for the indoor robot localization is proposed. This system solves the problem of localization by using an array of LEDs distributed uniformly in the environment. The localization process is achieved by collecting the information from the group of the LDR sensors, which equipped on the robot. The Binary search algorithm is used to reduce the time of the localization process by controlling the lights of the LEDs array. The minimum bounded circle algorithm is used to draw a virtual circle from the information collecting by the LDRs sensors and the center of this circle represents the robot location. The suggested system is simulated on an environment with (32*32) LEDs arrays. The simulation result of this system shows a good performance in the localization process.

**SD3.3 11:40** ***A New Reinforcement Learning-Based Framework for Unbiased Autonomous Software Systems***

Ismail Sulaimon (King saud University, Saudi Arabia)

From the newsfeeds, the products and services advertised to us, job screening, risk analysis, facial recognition and to the results we get through search engines, human-curated algorithms sitting behind the scenes, are making these decisions. These algorithms sometimes display the choices of those who authored them. Algorithmic bias has always been a minor issue since the advent of computer software, not until now that computer algorithms are deeply rooted in our daily lives through smart devices, intelligent software solutions and autonomous system. We are at the edge of leaving our critical decisions in the hands of these intelligent creations of ours. Whereas, the biases in the algorithms used to develop them and the biases in the data they were trained with are obviously still in existence. This research is aimed at adapting the existing bias detection mechanism to ensure fairness in the decision-making process of autonomous software systems. The final solution is in the form of a software module which provides access for auditing decision process of machine learning powered autonomous software systems. This, in turn, ensures fairness in the decision process of autonomous software systems.

**SD3.4 12:00** ***Modeling, Simulation and Design of Adaptive 6DOF Vehicle Stabilizer***

Mohammad Alkhedher, Uzair Ali and Omar Mohamad (Abu Dhabi University, United Arab Emirates)

Six Degree of Freedom (6 DOF) parallel manipulators have been utilized for many applications. In this paper, a 6 DOF manipulator is used as a robust vehicle stabilizer in order to fix the orientation of the upper platform. The paper starts with kinematic analysis of a Stewart platform. This analysis is formulated to cope

with the design of vehicle stabilizer. The design and selection of mechanical components including primary joints based on comprehensive dynamic simulation. After validating simulation results of proposed design, they were implemented in to build a physical model. To improve system accuracy and performance, and to eliminate associated vibrations, a linear regression model of ground rise is embedded in the system to estimate and predict upcoming elevations. This has lowered the percentage error of platform orientation, made the system more stable.

### SD3.5 12:20 *Path Planning in Dynamic Environment Using Particle Swarm Optimization Algorithm*

Saleh Alaliyat and Rachid Oucheikh (Norwegian University of Science and Technology, Norway); Ibrahim Hameed (Norwegian University of Science and Technology, (NTNU) in Alesund, Norway)

Path planning is an important guidance task that allow autonomous mobile robots and vehicles to achieve their goal or fulfill a mission. In this paper, a new path planning algorithm based on Particle Swarm Optimization (PSO) is proposed. This algorithm is able to perform comfortable and smooth maneuvers from source to destination while ensuring the safety of the autonomous vehicle and its surroundings. The optimization criteria consist of collision-free path length, travel time and energy consumption. Various test scenarios are used to test the effectiveness of the proposed method for generating feasible and optimal solutions. Simulation in Unity3D is used to illustrate and validate the proposed approach. Results showed that the proposed approach is efficient and optimal in terms of relevant objective functions for various test scenarios.

## SD4: Thermal and fluid systems 1

Room: Nadwa 2 5th Level

Chair: Chaouki Ghenai (University of Sharjah, United Arab Emirates)

### SD4.1 11:00 *Modeling and Simulation of Entropy Generation Rate in Pendulum Cart System Undergoing Damped Oscillation*

Amin A. Mohammed (King Fahd University of Petroleum & Minerals, Saudi Arabia); Mehmt Sunar (Mechanical Engineering Department, Yildirim Beyazit University); Ahmet Z. Sahin (King Fahd University of Petroleum & Minerals, Saudi Arabia)

When subjected to a damped oscillation, a mechanical system destructs exergy while reducing the energy efficiency of the system through entropy generation. Thus, entropy generation rate in mechanical system undergoing a damped oscillation is necessarily to be investigated for efficient handling. A mechanical system consisting of a cart with slender rod is considered in this work for entropy generation rate via a thermodynamic analysis. The dynamic model of the system is formulated using Lagrange's equations and afterwards it is linearized for small rotation of the rod. The entropy generation rate is then introduced as the time derivative of the net work potential of the system. Entropy generation rate is simulated for different initial conditions and a parametric study is performed to examine the effect of different parameters such as damping and stiffness on the entropy production. It is found that, the stiffness and initial conditions have direct effect on the entropy generation rate. In this case, increasing either property increases entropy generation rate. However, no general trend is observed for the effect of damping due to the coupled nature of the system.

### SD4.2 11:20 *Design of Winter Air-conditioning System*

Karthik Silaipillayarputhur (King Faisal University & College of Engineering, Saudi Arabia); Hassan Khurshid, Ibrahim Al Da'ej, Abdulaziz Al Baroot, Abdullah Al Naim and Mohammad Al Naim (King Faisal University, Saudi Arabia)

The project work aims to design a winter air conditioning system for the mechanical engineering section of the college of engineering building at King Faisal University, KSA. The winter air conditioning system consists of a heating system, humidity control system and a steam trap system. The basic design of the heating system was considered in this work. Therein, a cross flow heat exchanger was developed such that the room air exchanges heat with steam. Air, the external fluid, undergoes sensible heat transfer and while steam, the tube side fluid, undergoes phase change. Performance charts were developed to study the performance of the heat exchanger as a function of NTU and heat exchanger pass. Also, generalized equations were developed to study the external fluid temperature exiting each pass of the heat exchanger. Such generalized equations have not yet been reported in the available literature.

### SD4.3 11:40 *Performance of Solar Lithium Bromide Water Absorption Air-Conditioning System for a Conference Hall in Hot Desert Climates*

Chaouki Ghenai, Oussama Rejeb and M. Bettayeb (University of Sharjah, United Arab Emirates)

The main objective of this study is to assess the performance of solar Lithium Bromide-Water absorption air conditioning system for a conference hall under hot climate conditions. The goal is to replace conventional air condition system with compressor cycle consuming high electrical power with solar based absorption chiller (increase the integration renewable resources in the energy mix, and reduce the electrical power consumption and the greenhouse gas emissions). Modeling and simulation analysis was used in this study to calculate the cooling loads of the hall; test the daily performance of the solar absorption air conditioning unit; and determine the conditions to achieve and maintain cooling conditions (temperature and humidity) to meet the requirement of the conditioned space. The results show the maximum cooling load of the hall (total floor area is 280 m2) for the month of July in Sharjah is 52 kW, the maximum useful energy gained by the parabolic trough collector PTC is 79 kW (total area of the PTC is 133 m2 and the thermal efficiency of the PTC collector is 72%), and the average coefficient of performance of solar absorption system is 67%.

### SD4.4 12:00 *Effects of Fibre Orientations and Flow Channel Patterns on the Durability of Composite Bipolar Plates Used in PEMFCs*

Fatih Darıcık (Alanya Alaaddin Keykubat University, Turkey); Alparslan Topcu and Gökhan Tüccar (Adana Science And Technology University, Turkey); Kadir Aydin (Çukurova University, Turkey)

Fuel cells which are electrochemical devices have gained popularity in last three decades as an alternative energy resource. Especially PEM fuel cells (proton exchange membrane or polymer electrolyte membrane) are one of the most developed fuel cell types and use in transportation (automotive) applications. Bipolar plates (BPs), on the other hand, responsible for distribution of reactant gases and collect of current in PEM fuel cell stack. Flow channels mill on bipolar plates for the purpose of distribution of gases to the fuel cell system. These flow channel patterns can be different types such as parallel, serpentine, grid, spiral, cascade. In addition, bipolar plates manufacture from graphite materials usually owing to its superior features such as high electrical conductivity high and corrosion resistance. Besides, they can be manufacture from metallic plates, alloys and composite materials. In present study, carbon/epoxy laminated composite BP models were prepared with four different flow channel patterns (parallel, serpentine, grid and spiral) and four different stacking sequences of reinforced plies. After, the effects of fibre orientations and flow channel patterns on the carbon/epoxy laminated composite BPs were investigated numerically under thermal loads. Deformations of the models and the stresses on the models were evaluated. Warping of the BPs was determined by benchmarking int

### SD4.5 12:20 *Aerodynamics Optimization of RC Plane Winglet*

Abid Abdul Azeez, Mohamed S. Gadala, Nasr Al Khudhiri and Sharul Sham Dol (Abu Dhabi University, United Arab Emirates)

This project deals with understanding the various steps involved in performing finite element analysis of computational fluid mechanics systems to enhance the aerodynamics performance of the RC plane for SAE competition. The analysis is conducted for the complete airplane and for the wing optimization. Various

modifications are applied to the wing and is analyzed first and then the best cases are applied to the whole airplane. The steps include creating a modeling plan, material selection, geometric modeling, model meshing, applying boundary conditions, and obtaining the required results by solving the models. The software used to conduct the finite element analysis is Workbench. Once the results are obtained, model and result verification are done to validate the data. It is concluded that the airplane-45 degrees winglet has the highest lift force with the minimum drag.

# SD5: Fuzzy Sets and Systems

Room: Nadwa 3 5th Level

Chair: Jihene Kaabi (University of Bahrain, Bahrain)

### SD5.1 11:00 *Fuzzy logic Lagrangian Relaxation Selection method for the Solution of Unit Commitment Problem*

Jabri Majed (Saudi Electricity Company, Saudi Arabia); Helmi Aloui (ENET'Com, Tunisia); Hamid AlMuzaini (Saudi Elctricity Company, Saudi Arabia)

This paper presents a modified Lagrange relaxation to provide efficient solutions for formulating the unit commitment problem. The unit commitment problem is solved by using the Fuzzy logic tuning of the Lagrangian multiplier λ. The main function of the Unit Commitment takes into consideration the spinning reserve, start-up cost, minimum up and minimum down time constraints. This paper describes the proposed modification and presents the test results on a benchmark system comprising 10 generators. The results reflect the robustness of the modified algorithm in solving the unit commitment problem compared with the conventional method.

### SD5.2 11:25 *Optimization of Nonstationary Fuzzy Set Using Genetic Algorithm*

Hasan Yetis and Mehmet Karakose (Firat University, Turkey)

The high computational complexity of type-2 fuzzy systems causes the need for alternative methods. Nonstationary fuzzy system, which aims to model the type-2 fuzzy sets with a number of type-1 sets obtained by the help of perturbation function, is one of these methods. In this study, the sub-type-1 fuzzy sets used in nonstationary systems are optimized according to the system requirements by the help of genetic algorithm. Thanks to the convergence of genetic algorithm, the obtained sub-type-1 fuzzy systems are close to the best solution. So, the obtained nonstationary set which is generated using genetic algorithm gives us a better solution instead of the nonstationary fuzzy sets created by perturbation functions which are based on mostly randomness. The success of the obtained nonstationary fuzz set is proven by the simulation results.

### SD5.3 11:50 *Fuzzy C-means Detection of Leukemia based on Segmentation*

Abdellatif Bouzid-daho (University of Annaba, Algeria)

The detection of abnormal blood cells by the different systems diagnostic aid makes medical appeal to the segmentation of images (clustering), when it is the essential step prior to the interpretation of the latter. It is to achieve a partition of the image in the homogenous zones corresponding to the objects contained in this last. The algorithms of clustering has become necessary due to its importance in the biomedical field, fuzzy c-means is widely exploit for the segmentation of medical images, the objective of this paper is detected the abnormal blood cells using the approach (FCM), this last allows us to extract the infected regions from a blood cell reach leukemia (cancer of the blood white cells), results show that our proposal considerably improved the efficiency of previous approaches. We use several medical databases to validate our results.

### SD5.4 12:15 *Investigating Delay Factors in Electrical Installation Projects using Fuzzy TOPSIS*

Sadeque Hamdan, Anwar Hamdan, Ahmed Bingamil and Hassan Al-Zarooni (University of Sharjah, United Arab Emirates); Hamdi Bashir (University of Sharajah, United Arab Emirates); Imad Alsyouf (University of Sharjah, United Arab Emirates)

The common objective of most of studies that have investigated causes of project delays was to prioritize delay factors in a specific country by conducting opinion surveys of contractors, clients, and/or consultants using a Likert scale and simple ranking methods ignoring the fact that prioritization of delay factors is a multi-criteria problem that is subject to vagueness and uncertainty. To overcome this limitation, this paper proposes the use of fuzzy TOPSIS. The usefulness of this method is demonstrated by investigating delay factors in electrical installation projects carried out by an organization in the United Arab Emirates.

# SD6: Electromagnetics

Room: Nadwa 4 5th Level

Chair: Lutfi Albasha (American University of Sharjah, United Arab Emirates)

### SD6.1 11:00 *On the use of Underground Conduits as Potential Means for Transmitting Data*

Amina Alnaqbi, Lutfi Albasha and Mohamed Badr (American University of Sharjah, United Arab Emirates)

This paper presents an analysis of the risks involved that underground conduits have the potential to be exploited as a medium for communication. The importance of this topic lies in obvious dangers that arise from such potential being exploited without clear awareness and regulation from the responsible owning party of the conduit infrastructure. There has been little research that directly examines or explore/review this risk. This paper introduces various modeling and simulation evaluations. To validate the presented hypothesis, a prototype was built with limited scale but with real world parameters, both in the physical setup and computer simulation ones.

### SD6.2 11:20 *A Comprehensive Study of Proposed Linear Design Procedures for Low-Speed Axial-Field PMSG*

Walid A. M. Ghoneim (Arab Academy for Science and Technology, Egypt); Mohamed Abdo Husien (Arab Academy for Science and Technology and Maritime Transport, Egypt); Hamdy Ashour (Arab Academy for Science and Technology (AAST) & Arab Academy for Science and Technology (AAST), Egypt)

This paper presents comprehensive linear design procedures for low speed axial field PMSG. The proposed procedures take into consideration a wide combination of Design limitations, such as shear stress, permeance coefficient, air gap length and current density. For validation purposes, two different case studies of pre-published cored and core-less machines are redesigned using these procedures. The differences in the resulting dimensions were considered then (FEM) software is used to validate the linear design in each case. Consecutively, a comparison is held between the analytical design and FEM results to verify the suggested approach. The aim is to demonstrate the promising results of the proposed linear design procedures, which produced machines with enhanced performance at reduced active materials and manufacturing costs. The results show that the suggested linear design steps are favorable for low speed axial field PMSG machine design.

**SD6.3 11:40** ***Design of an Axial Field Permanent Magnet Generator for Small-Scale Water Turbines - Focus on Stacking Factor Effects on Performance***

Walid A. M. Ghoneim (Arab Academy for Science and Technology, Egypt); Mohamed Abdo Husien (Arab Academy for Science and Technology and Maritime Transport, Egypt); Hamdy Ashour (Arab Academy for Science and Technology (AAST) & Arab Academy for Science and Technology (AAST), Egypt)

This paper presents the modelling and design of a small scale Axial Field Permanent Magnet Synchronous Generator driven by a low-head and low-speed water turbine. Firstly, the study suggests a water turbine that can be used to extract small-scale hydraulic power, then means to calculate the produced mechanical power and performance. Secondly, an overview of AFPM generators is presented. Afterwards, a generator is analytically designed through sizing equations, then its dimensions and performance is validated using FEM software. This generator is redesigned after decreasing the stacking factor, using FEM-based sensitivity analysis to present a new hybrid one comprising the advantages and disadvantages of cored and coreless AFPM machines.

**SD6.4 12:00** ***Modeling of Distribution Transformer for Analysis of Core Losses of Different Core Materials Using FEM***

Kamran Dawood and Guven Komurgoz (Istanbul Technical University, Turkey); Fatih Isik (Astor Transformers, Turkey)

The core losses of the transformer are mainly dependent on the material of the transformer core. The material of the transformer core just not minimize the cost of the core losses but also increase the lifetime of the transformer. M5 material cold rolled grain oriented silicon steel is generally used for the manufacturing of the core of the transformer. In this study, 2- Dimensional finite element models are used to determine the core losses of the transformer. M5 and M4 cold rolled grain oriented silicon steel material was used for the manufacturing of the transformer core. In this study, a core losses of the three phase distribution transformer with a power of 400 kVA and a voltage level of 30 / 0.4 kV was investigated and the results presented in this paper are based on the finite element analysis. The results show that the core losses in the M4 cold rolled grain oriented silicon steel material are lesser than the M5 core material. For validation, the results of the finite element results are compared with the experimental results.

**SD6.5 12:20** ***Analyzing of Wind Distributed Generation Configuration in Active Distribution Network***

Ali M Eltamaly (King Saud University, Saudi Arabia); Yehia Sayed Mohamed and Abou-Hashema Mustafa El-Sayed (Minia University, Egypt); Amer Nasr Abd Elghaffar (Minia, Saudi Arabia & Minia University, Egypt)

With the increasing on the electric power demand and the extension on the power system. There are many un-preferred conditions in the system as voltage drop, sag, over, under frequency and so on. The transmission power to the remote loads is required to install the new transmission lines and to construct the new power plants that directly translated to additional cost. Using the Distributed Generations (DGs) near the loads can enhance the power system quality by saving the voltage stability and decrease the losses power. The renewable solar cell generation and wind energy sources are considered the famous renewable generation, which considered more saving running cost and friendly environmental at comparing with the traditional power plant. The wind generation is consisting of one of the famous renewable energy sources, because of the wind generation has zero emission, its abundant and freely available in the nature. In this paper, a detailed analysis of using the wind DGs with the distribution power network and the optimum power control curve algorithm to control the wind turbine rotor speed. Also, this paper uses the power world simulator software to describes the contributions of using the wind DGs near the loads for enhancing the power system quality. The simulation in this paper presents with the IEEE-12 busbar 33 kV distribution system network to shows the difference voltage and the power losses without and with adding the wind DGs.

# Tuesday, April 16 12:40 - 14:00

## Networking and Lunch Break

# Tuesday, April 16 14:00 - 15:40

## SE1: Applied Mathematics 3

Room: Al Majlis 4th Level

Chair: Faisal Al-Showaikh (University of Bahrain, Bahrain)

**SE1.1 14:00** ***New version of Gauss Seidel iterative method for operators system to approach Fredholm integral equation***

Samir Lemita (Ecole Normale Supérieure de Ouargla, Algeria); Hamza Guebbai (Université 8 Mai 1945, Guelma, Algeria); Ammar Khellaf (Université 8 Mai 1945, Guelma & Laboratory of Applied Mathematics and Modeling, Algeria)

In this work, we propose a new version of Gauss Seidel iterative method for operators system to solve a one linear Fredholm integral equation of the second kind defined on large interval. The convergence analysis of the procedure is proved and some numerical examples show its effectiveness compared to the classical method of Gauss Seidel.

**SE1.2 14:20** ***Maximum GP Lens and Post-lens Tear Film Thickness Allowed to Avoid Corneal Hypoxia for Two of the Highest GP Lenses Permeability Currently Available in the Market***

Fehaid Alshammari (Al-Imam Mohammad Ibn Saud University, Saudi Arabia)

Contact lenses composed of different material and designs may have unique fitting characteristics that impact preand post-lens tear films thickness. Currently, two of the highest GP lens permeabilities in the market are 140 and 163 barrers. We here find the maximum post-lens tear film and GP lens thicknesses enable us to prevent corneal hypoxia when one of the two lenses are used.

**SE1.3 14:40** ***Expected genomic dissimilarity***

Bhadrachalam Chitturi (Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Amritapuri); Krishnaveni K S (Amrita Vishwa Vidyapeetham, India)

Permutation, a discrete structure, is a sequence on the corresponding alphabet Sigma where every element of Sigma occurs exactly once. The set of permutations over Sigma forms a symmetric group denoted by Sn. Permutation models a genome in evolutionary biology. If P = P1, P2, ...Pn is a permutation over Sigma=0, 1,..., n-1 then Pi and P(i+1) form an adjacency if Pi+1= P(i+1). Various operations that model genomic mutations are defined over permutations. An operation is defined by a set of moves. The distance between a pair of permutations alpha and beta under a given operation O is the minimum number of moves that are required to transform alpha into beta. It denotes genomic dissimilarity between alpha and beta. Computation of distance is intractable for

various operations including transposition. We call prefix transposition, suffix transposition and transposition as block-moves. Based on properties of Sn related to adjacencies we develop a model that estimates the expected block-move distance between any pair of permutations.

### SE1.4 15:00 *Stability Analysis of Fractional Derivative Modeling of Free Convective Flow over a Vertical Plate*

Mohamed F. El-Amin (Effat University, Saudi Arabia)

The problem fractional derivative of flow and heat transfer by natural convection from a heated semi-infinite wall immersed in a fluid is studied numerically. The time derivative terms in both the momentum and energy equations are assumed fractional. Fractional derivative is a generalization to the normal derivative and it would be interesting to study its possible effects on both velocity and temperature fields. For accurate implementation, it is important that the results obtained by fractional derivative formulations reduce to the results obtained by the normal derivative when the order of differentiation becomes the same. In this work, it is found that both the velocity and temperature profiles using fractional derivatives around first order (i.e., smaller and larger than one) encompass those obtained using first order time derivative. Nusselt number variations, as well as friction coefficient profiles, follow a similar pattern.

### SE1.5 15:20 *Factor Analysis-Based Approach for the Decomposition of the Multiple Traveling Salesman Problem*

Basma Hamdan (University of Sharjah, United Arab Emirates); Hamdi Bashir (University of Sharajah, United Arab Emirates)

TThis paper proposes a new two-stage clustering approach for the decomposition of the Multiple Traveling Salesman Problem (mTSP). In the first stage, the clusters are identified, using a slightly modified version of factor analysis. In the second phase, the customers (cities) are assigned to the formed clusters using an integer-programming model. To evaluate its performance, the proposed approach with a genetic algorithm was applied to a set of seven test problems with nine different numbers of salesmen. The results obtained were then be compared with those of the best well-known clustering technique, k-means++ with a genetic algorithm. Evaluation of the obtained solutions showed that the proposed approach, with the genetic algorithm, had the best performance in terms of a number of criteria.

## SE2: Efficiency and Data Envelopment Analysis

Room: Al Marsa 4th Level

Chair: Mohamed Dia (Laurentian University, Canada)

### SE2.1 14:00 *Solving DEA models in spreadsheets and modeling languages*

Josef Jablonsky (University of Economics, Prague, Czech Republic)

Data envelopment analysis (DEA) models are tools for efficiency and performance evaluation of a set of decision-making units (DMUs). They are formulated as linear programming problems that have to be solved for each DMU of the given set. The paper discusses problems with solving DEA models and presents an original system written in LINGO modeling language and using MS Excel as the user's interface. This system covers main DEA models including multiplier and envelopment models, models for ranking of DMUs, network models, etc. Depending on the version if the LINGO system the DEA solver can analyze problems from 200 until the unlimited number of DMUs.

### SE2.2 14:20 *Properties of DEA models with assurance region*

Petra Zýková (University of Economics, Prague, Czech Republic)

The paper deals with DEA models with assurance region (DEA/AR). These models are used for ranking of candidates in advanced voting systems. The main aim of these systems is to find a general winner among all candidates and their complete ranking. Every voter gives a ranking of the first t-candidates according to his/her preferences and advanced voting systems consist in an application of data envelopment analysis (DEA) models originally proposed for this purpose. This paper deals with properties of these DEA models with assurance region. A numerical example with 11 candidates is used for illustrative purposes. Its results for all presented models are compared especially with respect to the vectors of weights.

### SE2.3 14:40 *Design Efficiency Analysis Towards Product Improvement Using DFMA*

Manish Gupta and Satish Kumar (Motilal Nehru National Institute of Technology Allahabad, India)

DFMA is a methodology which is used to select the optimum design in the early stages of product design. This paper deals with the modeling of pedestal fan using DFMA method. Method used for DFMA analysis is Boothroyd Dewhurst method. The aim of study is to analyse the existing design of pedestal fan and to identify the pockets of improvement and suggest the new design of pedestal fan with improved design efficiency. DFMA is a concurrent engineering tool that is used to improve the design of the product which leads to minimization of the production cost. It also shortens the product development time by reducing the number of components, increases the quality of the product as well as reduces the overall product cost by reducing the assembly cost as well as manufacturing cost. Part modelling of each component of existing design as well as improved design of pedestal fan was done with the help of design software. Increase in the design efficiency shows the easy assembly process i.e. less time taken during assembly operation of new design in comparison to the existing design.

### SE2.4 15:00 *Relative Performance Evaluation of Ontario's Sawmills with Bootstrap DEA*

Mohamed Dia and Shashi Shahi (Laurentian University, Canada)

This study uses a non-parametric technique, Bootstrap Data Envelopment Analysis (DEA), in analyzing the relative technical efficiency of 125 Ontario's sawmills (with 1402 sample data observations) collected over a period of 17 years (1999 to 2015). The results indicate low levels of overall technical and managerial efficiencies in the Ontario's sawmills over the entire study period. The main source of inefficiency of the sawmills was the management of operations, especially when these sawmills were not able to adjust their inputs with changing and uncertain market demand conditions. These results provide policy makers and sawmill managers with comprehensive details of relative technical efficiencies in Ontario's sawmills, so that future resources can be reallocated to improve the performance of forest products industry in Ontario.

### SE2.5 15:20 *The Use of Data Envelopment Analysis in Measuring the Performance Efficiency - Evidence from Bahrain*

Abdelmohsen Desoky (University of Bahrain, Bahrain); Gehan Abdel-hady Mousa (University of Bahrain, Bahrain & College of Business Administration, Egypt); Elsayed Elamir (University of Bahrain, Bahrain)

This study uses two models of the data envelopment analysis (DEA) to measure the performance efficiency of a sample of listed Bahraini banking firms. The first model (CCR Model) which introduced by Charnes, Cooper and Rhodes (1978) was used to measure the overall technical efficiency; while to measure pure technical efficiency and scale efficiency as two components of the overall technical efficiency, the second model (CCB Model) introduced by Banker, Charnes and Cooper's model - BCC (1984) was applied. Although the use of two different models to measure performance efficiency led to different results, each model has its own characteristics and uses. Therefore, the decision maker must determine his/her needs before selecting a model to be used in the measurement of corporate performance efficiency. The main finding indicates that different models provided different results over the 2013-17 period.

# SE3: Soft Computing Theory and Applications

Room: Nadwa 1 5th Level

Chair: Ahmed M. Zeki (University of Bahrian & College of IT, Bahrain)

**SE3.1 14:00** ***Forecasting of Bahrain Stock Market with Deep Learning: Methodology and Case Study***

Khaled Al-Thelaya (KFUPM, Saudi Arabia); El-Sayed M. El-Alfy (King Fahd University of Petroleum and Minerals, Saudi Arabia); Salahadin Mohammed (King Fahd UNiversity of Petroleum and Minerals, Dhahran, Saudi Arabia)

Deep learning applications and technologies may shape the future of technology and data science. Recent trends in machine learning reveal a growing interest in deep learning methodology to a wide range of complicated problems that were infeasible using traditional methodologies. In this paper, we present a new deep learning predictive model for stock market forecasting. The historical data of Bahrain Bourse all share index is employed to perform the experiments. The proposed forecasting model is developed using a combination of LSTM autoencoder and stacked LSTM network. We also augment the input features with two of the most common technical indicators in order to improve forecasting performance. The developed model is compared with traditional LSTM and shallow MLP networks.

**SE3.2 14:25** ***Multi-scale LPQ-DCT for Image Forgery Detection***

Atif Shah and El-Sayed M. El-Alfy (King Fahd University of Petroleum and Minerals, Saudi Arabia)

Nowadays, image processing tools with advanced and easy-to-use features are becoming available making image manipulation much simpler than ever before. With the wide spread use of images, image authenticity is crucial and it is essential to be able to passively detect forgery when the original image is not accessible. In this work, we proposed an image forgery detection model based on the variations of the discrete cosine transform coefficients of transformed images using local phase quantization at different scales. Texture features are extracted by the proposed method and employed to train a support vector machine for image classification. Variants of the proposed model are evaluated on two publicly available benchmark datasets for color images and compared to other existing methods. The results demonstrate that significant improvement can be achieved.

**SE3.3 14:50** ***Enhancing Branch Predictors using Genetic Algorithm***

Md. Arifuzzaman (University of Bahrain, Bahrain); Md Rafiul Hassan (King Fahd University of Petroleum and Minerals (KFUPM), Saudi Arabia); Md Sarwar Morshedul Haque (King Fahd University of Petroleum and Minerals, Saudi Arabia); Joarder Kamruzzaman (Federation University Australia, Australia)

Dynamic branch prediction is a hardware technique used to speculate the direction of control branches. Inaccurate prediction will make all speculative works useless while accurate prediction will significant improve microprocessors performance. In this work, we have shown that Genetic Algorithm (GA) can be used to select (near) optimal parameters for branch predictors in most cases. The GA-enhanced predictors take time to find suitable parameters, but once the values of these parameters are determined, the GA-enhanced predictors take the same time to execute as the basic predictors with increased accuracy.

**SE3.4 15:15** ***Using Feature-Level Fusion for Multimodal Gender Recognition for Opinion Mining Videos***

Sadam Al-Azani (KFUPM, Saudi Arabia); El-Sayed M. El-Alfy (King Fahd University of Petroleum and Minerals, Saudi Arabia)

Video has rich content and recently has received considerable attention for opinion mining and sentiment analysis, especially with the growing volume of online videos in social networks. However, it has been proved that machine-learning techniques for sentiment analysis are gender biased, i.e. can be more accurate for one gender than the other. Hence, if gender can be recognized early, it can lead to improving the sentiment analysis results. The aim of this paper is to explore multimodal analysis of video data to extract features and build gender recognition models. Different methods are evaluated for unimodal, bimodal and trimodal systems using features from the three modalities: visual, audio, and text. The experimental results demonstrated that combining different modalities can significantly improve the gender recognition rate as compared to unimodal models.

# SE4: Engineering Management

Room: Nadwa 2 5th Level

Chair: M'hammed Sahnoun (France & CESI, France)

**SE4.1 14:00** ***Review on Traditional and Agile Cost Estimation models***

Smiju Sudevan (MODERN COLLEGE OF BUSINESS AND SCIENCE, Oman); Faiza Al Azizi and Fatma Al Shaaily (Modern College of Business and Science, Oman)

Software development projects had a history in delivering beyond schedule and budget and not meeting customer requirements. For many years, traditional development models such as waterfall model was used to develop software systems, but recently agile models came to the picture and is increasingly used in developing software due to many reasons like simplicity, what is coming requirement changes, lightweight approach and delivering products to the customer in short time. Despite the development method followed, the challenge of accurately estimating effort, size and time for the project still exist. This review paper focus on the existing estimation models used in traditional as well in agile software development.

**SE4.2 14:25** ***Determinants of Quality of General Secondary School Mathematics Education: The Case of Ethiopia***

Getinet Walde (Beijing Institute of Technology, P.R. China & Mettu University, Ethiopia)

This paper examines determinants of quality of mathematics education. A multi-stage random stratified sampling method was used to select students and schools. Quantitative data were analyzed in terms of descriptive statistics and multiple regression analysis. Due to class size, teachers teaching skills, low student's mathematics background the actual status of teaching mathematics was lecture method. On the other hand, family supports, students' mathematics background, interest and motivation of students and teachers, participation of students and cooperation between students and teachers were the most significant predictor of students' mathematics achievement.

**SE4.3 14:50** ***Simulation-Based Approach for Reducing Goods Loading Time***

Chayut Bunterngchit (King Mongkut's University of Technology North Bangkok, Rayong Campus, Thailand); Sudawan Leepaitoon (King Mongkut's University of Technology North Bangkok, Rayong Campus, Thailand)

This research studied a finished goods warehouse of cold rolled steel coils manufacturing factory from storing to dispatching. It was aimed to develop a new warehouse layout alternative to reduce goods loading time from a warehouse to trucks before dispatching. By collecting data of an existing warehouse, it was found that the average loading time of a steel coil to trucks was 17.43 minutes per coil, which exceeded the Key Performance Indicator (KPI) of the factory that

was 15 minutes. The main cause of the problem was from inappropriate coil arranging system. To solve this problem, ABC analysis was applied to classify the sizes of each coils according to the amount of sales. Then, the existing warehouse layout was simulated using Flexsim software, which showed that the average loading time to trucks was 17.82 minutes per coil, which was very close to the actual loading time. Finally, dedicated storage policy based on ABC analysis was applied to design a suitable layout along with simulated the scenario of the proposed layout. The simulation showed that if the proposed layout has been implemented, loading time to trucks would have reduced from 17.82 to 13.20 minutes per coil. The time reduction was 4.62 minutes or 25.93%.

### SE4.4 15:15 *Wind Turbine Components Classification based on Failure Causes: for Proactive Maintenance Simulation*

Fatima Souad Bezzaoucha (Ecole Superieure en Informatique de Sidi Bel Abbes, Algeria); M'hammed Sahnoun (France & CESI, France); Sidi Mohamed Benslimane (ESI SBA, Algeria)

Predictive, proactive and reliability-based maintenance are considered among the most widely used approaches in the field of maintenance optimization of wind turbines. Nevertheless, most existing models are designed to optimize the maintenance of a single component of a wind turbine and do not take into consideration the different dependencies that exist between components, which does not guarantee the performance of the system. This paper proposes a detailed classification of the various components of a wind turbine according to their causes of failure based on the stochastic dependencies, which characterize the process of degradation of the system. The purpose of this classification is to allow maintenance operators and manufacturers both to have efficient systems in terms of performance, reliability and cost.

## SE5: Modeling 2

Room: Nadwa 3 5th Level

Chair: Hayat Mohamed Abdulla Ali (, Bahrain)

### SE5.1 14:00 *An Environmental Air Traffic Flow Management Model*

Sadeque Hamdan and Ali Cheaitou (University of Sharjah, United Arab Emirates); Oualid Jouini (Ecole Centrale Paris, France); Zied Jemai (University of Tunis Elmanar, Tunisia); Imad Alsyouf and Maamar Bettayeb (University of Sharjah, United Arab Emirates)

Despite the critical effect of CO2 emissions of the aviation sector on the environment, none of the previous works on air traffic flow management (ATFM) has addressed this aspect from the perspective of the ATFM network operations. In this paper, we study this effect by proposing an ATFM bi-objective mathematical model that minimizes the total delay cost and the total CO2 emissions. The proposed model considers ground delay, air delay, flight rerouting, speed controls, and CO2 emissions and is solved using the weighted comprehensive criterion method. The illustrative example showed that reducing CO2 emissions by an average of 0.07% results in an average of 1.2% increase in the total delay cost. The consideration of CO2 emissions leads to a solution that favors ground holding rather than air holding or rerouting to longer paths.

### SE5.2 14:20 *Selection of Unmanned Aerial Vehicles by Using Multicriteria Decision Making in Defence*

Mustafa Hamurcu (University of Kirikkale, Turkey); Tamer Eren (Kırıkkale University, Turkey)

Unmanned Aerial Vehicles (UAVs) are sustained in flight without an onboard crew. UAVs are used to military and civil area. These vehicles are used to reconnaissance and observing in civil area. In addition to these aims, in military area, play key roles in attack and destroy missions thanks to the weapon systems added on them. So, these vehicles have become an important part of defence in the military area. The aim of study is to determine the most suitable vehicle type among unmanned aerial vehicle alternatives, based on the critical criteria determined by the opinions of academic experts by using decision making process. This paper presents an evaluation model based on the analytic hierarchy process (AHP) and the technique for order performance by similarity to ideal solution (TOPSIS). The AHP is used to analyse the structure of systems evaluating and to determine weights of the criteria, and TOPSIS method is used to obtain final ranking for unmanned aerial vehicles. The most suitable alternative used of both military and civil purposeful are selected separately among the ten alternatives with the AHP-TOPSIS methods.

### SE5.3 14:40 *Applications of the MOORA and TOPSIS Method for Decision of Electric Vehicle in Public Transportation Technology*

Mustafa Hamurcu (University of Kirikkale, Turkey); Tamer Eren (Kırıkkale University, Turkey)

The technological development of buses with new alternative concepts are evaluated in this paper. Bus transportation is an important system in the public transport which is cheap, flexible and, in many cases, in terms of capacity and speed. But increasing car traffic in the city centre and increasing the emission such as carbon dioxide in the air are some of the dangerous problems for urban life. So, it is needed the public transportation to stop increasing car traffic and needed the cleaner technology for air and environmental quality. Electric buses can play a major role for liveable cities with improving the urban air quality. But planners and managers have difficulty in decision making due to diversified electric buses together with the developing technology. Multicriteria decision making methods that are analytic decision processes, prepare a good solution for this problem. In this study, six electric bus are assessed under the special criteria with TOPSIS and MOORA methods which are the multi-criteria decision-making methods. Methods are applied to select the best electric bus under the five criteria. Thus, we have alternative electric bus ranking according to methods.

### SE5.4 15:00 *Mathematical modeling of the spread of epidemics*

Natalia Lazareva (Siberian Federal University, Russia)

This paper presents the history and statistics of the spread of epidemics. A mathematical model of the time dependence of the parameters characterizing the spread of infectious diseases is constructed. The case when morbidity and recovery rates are different is considered. The laws of changes in the number of susceptible to the disease and in the number of infectious patients depending on the time are obtained. With the help of the constructed model the moment of time at which the number of infectious patients will be the maximum is found.

### SE5.5 15:20 *AADL*: A scalable AADL annex for modeling, analysis and verification*

Zhangtao Chen and Jing Liu (East China Normal University, P.R. China)

Architecture Analysis and Design Language (AADL) is a modeling language that is widely used in modeling application system architectures due to its simple syntax, powerful functionalities and strong extendibility. However, AADL does not have a comprehensive methodology to model all aspects of the target system, and its modeling is limited to pre-defined elements in the grammar. There is not a universal and complete framework to support the entire process of AADL modeling, analysis and verification. In this paper, we proposed a new annex called AADL* as an extension of AADL. It introduces the user-defined mechanism, which enhances the expressive power of the AADL core language. The customization of variable and function in AADL* can describe attributes and behaviors that AADL elements cannot express, covering hardware/software operations and hybrid aspects. The AADL* annex also provides a framework to support the transformation from AADL models to verification tools, enabling the integration of modeling, analysis, and verification. Moreover, we have developed the plugin

based on OSATE (Open-Source AADL Tool Environment) to support our new annex, which automatically converts AADL models into Z3 solver for verification. To demonstrate the feasibility and flexibility of our approach, the famous Apollo Automatic Driving System is modeled and verified according to the approach.

## SE6: Electronics

Room: Nadwa 4 5th Level

Chair: Mohab A. Mangoud (University of Bahrain, USA)

**SE6.1 14:00 *Smart and Green Street Lighting System Based on Arduino and RF Wireless Module***

Waheb Abduljabbar Shaif Abdullah (Faculty of Engineering Technology, Universiti Malaysia Pahang (UMP), Malaysia); Muhamad Aznawi Bin Yuzaidi, Kong Qi Yan and Ummu Sakinah Mohd Bustaman (Universiti Malaysia Pahang, Malaysia); Yasir Hashim (Ishik University, Iraq); Hani AlAriqi (Universiti Malaysia Pahang, Malaysia)

Street lights consume a huge amount of electric energy due to their conventional control systems that automatically turn ON and OFF either using timers or light dependent resistor (LDR). In addition, such systems use a high power pulps, which is not a good option for energy saving, thus it causes a huge waste of energy in the whole world. Green and Smart Street Lighting System, is necessity to overcome such issues, especially with the emergence of Smart City. Therefore, this project aims to design a smart and green street lighting system (SGStreet-LS) for saving energy and utilizing renewable energy sources efficiently. The proposed system composes powerful ideas and concept to smoothly and efficiently control the operation of street lightings based on the sunlight availability and the motion detection by exploiting Arduino-based controllers with RF wireless communication support. It also utilizes low power LEDs that supplied from solar panels to replace the conventional high power lights. Also a part of this project is to study the relationship of energy and environment based on the emission of CO2 level in the experiment, and validate the compatibility of real implementation of SGStreet-LS. In order to switching lights ON, there are to conditions to be satisfied: LDR sensor detects lower level of lights intensity (darkness situations), and PIR motion sensor detects the presence of an object in the street (vehicle/human). Otherwise, the street's lights will be switched OFF. As a result, by implementing SGStreet-LS, the electricity consumption for the street's lights can be reduced in addition to lowering CO2 level by using renewable energy sources. The lights turn on before pedestrians and vehicles come and turn off or reduce brightness when there is no one.

**SE6.2 14:20 *On Neural Networks Modeling Based on GA, PSO and GW Optimization Techniques***

Anwar Hasan Jarndal, Sadeque Hamdan and Maamar Bettayeb (University of Sharjah, United Arab Emirates)

Training artificial neural networks (ANNs) using global optimization techniques is becoming an attractive area of research. In this paper, combined modeling techniques of ANNs with genetic algorithm (ANN-GA), particle swarm optimization (ANN-PSO) and grey wolf optimization (ANN-GWO) will be presented. The performance of these three techniques will be investigated in terms of efficiency and effectiveness for solving practice modeling problem. It has been found the recently developed ANN-GWO has a comparable performance with respect to the other techniques. ANN-PSO showed higher rate of convergence, which makes it more practical for real-time applications.

**SE6.3 14:40 *On Modeling of Substrate/Buffer Loading in GaN HEMT Using Grey-Wolf Optimization Technique***

Anwar Hasan Jarndal and Mohamad Al Sabbagh (University of Sharjah, United Arab Emirates)

In this paper, four different equivalent circuit models to describe substrate/buffer loading effect in GaN HEMT on Si substrate have been investigated. The effect is characterized by Z-parameter measurements of open de-embedding structure for the considered device. A meta-heuristic optimization techniques called the Grey-Wolf Optimizer has been utilized to extract optimal values for the model elements. The models are validated by comparing their simulation results with the measured data. The extraction results are evaluated in terms of their accuracy and rate of convergence.

**SE6.4 15:00 *Temperature Sensitivity of Silicon Nanowire Transistor Based on Channel Length***

Hani AlAriqi (Universiti Malaysia Pahang, Malaysia); Waheb Abduljabbar Shaif Abdullah (Faculty of Engineering Technology, Universiti Malaysia Pahang (UMP), Malaysia); Yasir Hashim (Ishik University, Iraq); Hadi Manap (Universiti Malaysia Pahang, Malaysia)

This paper investigates the temperature sensitivity of Silicon Nanowire Transistor (SiNWT) depends on the gate length, and also presents the possibility of using it as a Nano- temperature sensor. The MuGFET simulation tool was used to investigate temperature characteristics of the nanowire. Current-voltage characteristics with different values of temperature and with different length of the Nano wire gate (Lg = 25, 45, 65, 85 and 105 nm), were simulated. MOS diode mode connection suggested to measure the temperature sensitivity of SiNWT. The final results show that the best temperature sensitivity of SiNWT based in largest ΔI occurred at working voltage VDD range 1 V to 3.5 V, depends on channel length range 25 nm to 85 nm and beyond the temperature sensitivity will be constant even the channel length increased up to 105 nm.

**SE6.5 15:20 *Design and Optical Simulation of a Sensor Pixel for an Optical Readout-Based Thermal Imager***

Ambali Alade Odebowale and Mohamed Ramy Abdel-Rahman (King Saud University, Saudi Arabia)

In this paper, we present an optical design and analysis of a single pixel element detector in an optical readout-based infrared imaging system. The proposed thermal imaging system contains no readout integrated circuitry and thus can be considered as a low cost alternative to typical thermal imaging system. In this paper, we present the design and optical simulation details for a fabry perot cavity filter (FPCF)-based sensor configuration operating in the transmission mode at 650nm and as a Long Wave Infrared (LWIR) absorber in the 8000nm-12000nm band. The temperature tuning of the FPCF resonant frequency is dependent on the thermo-optic sensitivity of its cavity layer. The performance of the FPCF sensor is considered at different cavity layer thermo-optic coefficients (TOCs) and for different thermal scene temperature variations. The proposed sensor was found to be sensitive to 50mK thermal scene temperature variations.

# Tuesday, April 16 15:40 - 16:00

## Coffee Break

# Tuesday, April 16 16:00 - 17:40

## SF1: Power Systems and Electric Drives

Room: Al Majlis 4th Level

Chair: Maamar Taleb (UOB, Bahrain)

### SF1.1 16:00 *Solar Powered Battery-Less Portable RO Desalination Unit: Simulation Studies*

Norrideen Mansour (University of Bahrain, Bahrain); Maamar Taleb (UOB, Bahrain)

PV-powered reverse osmosis (RO) is considered as one of the most promising forms of renewable energy powered desalination unit, especially when it is used in remote areas. In this work, we investigate the performance and efficiency of a battery less PV-RO unit powered directly and continuously from the PV array and compare it to the performance of a solar battery driven RO unit. The solar battery is charged during daytime using the PV array and runs the RO setup during nighttime. However, the energy provided by the PV array is intermittent and depends on daily available irradiations. Fortunately, in the case of the battery less unit the energy consumption of the RO unit can be adjusted by manipulating the brine flow rate or/and system pressure. In this work, we discuss two techniques for automatic adjustment of RO parameter (e.g. valve position at the brine) so that RO power consumption matches the maximum power provided by PV arrays. Matlab/Simulink implementations performed in these studies are presented and simulation results of battery less PV-RO system driven by UM and solar battery driven RO system are presented and compared

### SF1.2 16:20 *Harmonic analysis of high penetration level of Photovoltaic generation in distribution network and solution studies*

Lue Xiong and Mutasim I H Nour (Heriot Watt University, United Arab Emirates); Moustafa Shahin (Dubai Electricity and Water Authority (DEWA) & Heriot-Watt University, United Arab Emirates)

The high penetration level of Photovoltaic (PV) generation in distribution network reduces carbon emissions but also becomes problematic in terms of network management. Harmonic distortion is the main factor studied in this paper and a typical three-bus distribution network is built in MATLAB/Simulink to understand harmonic problem. Results show that current harmonics are more vulnerable to fluctuate compared to voltage harmonics. Based on existing harmonic standards, total demand distortion of current (TDDi) is evaluated to estimate maximum PV penetration level at Point of Common Coupling (PCC), and the maximum acceptable TDDi at each bus differs according to specific loading and short-circuit levels. Meanwhile, total harmonic distortion of current (THDi) at inverter outputs represents inverter performance. Instead of assessing at standard test conditions (STC), the impact of irradiance variations is studied. Low irradiance results in an increased THDi of the inverter whilst doesn't explicitly affect TDDi at PCC. A simple and low-cost solution which varies settings of inverter filter elements against irradiance is proposed, and harmonic distortion at low irradiance of the inverter is successfully mitigated.

### SF1.3 16:40 *Simulation Of Electro Mechanical Actuator For Missile Application By Dual Redundancy Technique*

B Sureshkumar (Chaitanya Bharathi Institute of Technology & OSMANIYA, India); Rakesh Babu Bodapati (Acharya Nagarjuna University & Bahrain Training Institute, Bahrain)

The military, defense missiles are self propelled systems with high security, reliability, and accuracy in targeting the obstacle. The firing of missiles is considered as milestones in growth of research areas. In such field, Electro Mechanical Actuator (EMA) helps to maintain the altitude of missile path, which is predefined path. Moreover, As EMA is exposed to environmental aspects, the altitude of missile may get effected. So on replicating the critical components i.e., BLDC drive and power inverter in EMA based control systems, the accuracy in monitoring the altitude is improved without any interruptions. This paper proposes dual redundant power inverter system to run BLDC motor with redundancy management and logic, fault tolerant and fault diagnosis by using MATLAB/SIMULINK with the results.

### SF1.4 17:00 *Influence of DDSG Wind Turbine on Power System Stability under Grid Disturbance*

Arshad Arshad, M. Tahir Niazi, Muhammad Mughal and Ashiq Hussain (HITEC University Taxila, Pakistan)

The penetration of distributed generation sources in the power system has increased many fold in the last few years. This is mainly due to the technological development in solar PV and wind turbines. Although these clean renewable energy sources offers many advantages, there are certain technical challenges to operate the system in the presence of increased penetration of distributed generation. This paper investigate the effect of wind power penetration in a standard two area power system. The influence of system inertia and fault on rotor angle and synchronous frequency has been investigated. Simulation results shows that the effect of fault and wind turbine on the system stability is related to inertia of the system. Furthermore, the bus voltage magnitude significantly decreased during fault and also after fault clearance.

### SF1.5 17:20 *The Three-Phase Cascaded VSI Topology Using Coupled Transformers for Grid-Connected PV Applications*

Abdullah Noman (King Saud University, Saudi Arabia); Abdulrahman Alolah (College of Eng.-King Saud University, Saudi Arabia); Khaled Addoweesh (King Saud University, Saudi Arabia); Ayman Alabduljabbar (King Abdulaziz City for Science and Technology, Saudi Arabia)

Cascaded multilevel inverter topologies have received great attention for grid-connected photovoltaic applications. In this paper, the three-phase cascaded voltage source inverter topology is proposed for grid-connected photovoltaic applications. The proposed control scheme is based on the classical control scheme, which is then extended to control the presented multilevel topology. Simulation is achieved by using SIMULINK environment. The simulation results show that the proposed topology is well functioning in improving the grid power quality. The grid currents are kept in phase with the grid voltages to ensure unit power factor, and the THD of the grid currents are within the acceptable limit. The proposed topology is experimentally implemented in the lab, and the switching pulses are generated with the help of MicroLabBox real time controller. The simulation and experimental results are presented to verify the proposed topology effectiveness and reliability.

## SF2: Algorithms for Scientific Computing

Room: Al Marsa 4th Level

Chair: Youssef Harrath (University of Bahrain, Bahrain)

### SF2.1 16:00 *Control of Axial Active Magnetic Bearing using Reduced Order Model*

Sudipta Saha (Indian Institute of Technology-Delhi, India); Mashuq Nabi (Indian Institute of Technology- Delhi, India)

Active Magnetic Bearing uses electromagnetic force, generated by current carrying coils to levitate the rotor freely. The application of active magnetic bearing embedded devices like Maglev Train, Fly wheel based energy storage system, Micro precision devices, Blood pump etc. are increasing in industries because of rapid progress in the electronics sector and controller structure. Finite Element is a method which allows numerical modelling and analysis of this kind of systems. In this paper, modelling and simulation of a 2D axial active magnetic bearing system is done using FE software COMSOL. The state space system matrices are extracted by creating probe points and a large order system is generated in MATLAB. Then using Krylov subspace based method, the order of the system is reduced. A PID controller is designed using reduced model and applied for full order model. The feasibility of the controller is tested using various

kind of signals and it is seen that the controller improves the performance of both systems. Therefore, this paper proposes a different approach for using reduced model instead of large order model for controlling axial active magnetic bearing

**SF2.2 16:20** ***Anti-unwinding Robust Attitude Control of Spacecraft with Limited States Measurement***

Syed Muhammad Amrr (Indian Institute of Technology Delhi, India); Sudipta Saha (Indian Institute of Technology-Delhi, India); Mashuq Nabi (Indian Institute of Technology- Delhi, India)

This paper proposes a control methodology for the attitude regulation of a rigid spacecraft without the measurement knowledge of angular velocities and is affected by parametric uncertainties and external disturbances. A finite time non-singular terminal sliding manifold based controller is developed to regulate the orientation of spacecraft. The proposed controller uses the estimated value of angular velocity by using a finite time state observer. The overall system stability is theoretically proven by Lyapunov analysis which ensures the convergence of attitudes in a finite time. Moreover, it shows that the proposed controller eludes the unwanted phenomenon of unwinding where the unnecessary large maneuvering path is taken by the spacecraft to reach the desired orientation. The effectiveness of the proposed controller is demonstrated by carrying out the numerical simulations for different initial conditions.

**SF2.3 16:40** ***Finite Volume TVD Scheme for a Nonlinear Gas Transport Model in Shale Rocks***

Iftikhar Ali (University of Hafr Al-Batin, Saudi Arabia)

Shale gas reservoirs are characterized by their ultra low permeability and the gas is trapped in a network of fractures. Expensive technologies such as hydraulic fracturing and horizontal drilling are used to release the gas from the shale rocks. The process of gas extraction is augmented with the use of transport models and experimental techniques. The gas transport models are developed so that they can capture the physics and the complexity of the fluid flow through shale rocks. In this work, a conservative finite volume TVD scheme is developed to obtain the numerical solutions of the gas transport model. Numerical model is validated against a time dependent advection diffusion equation whose exact solution is available, and then it is applied to a nonlinear gas transport model to find it's numerical solutions. The numerical solutions, in the steady state case, are compared against the experimental results that are obtained from pressure-pulse decay tests.

**SF2.4 17:00** ***Scheduling of identical parallel machines under unavailability constraints***

Youssef Harrath and Elham Iskandarnia (University of Bahrain, Bahrain)

This paper considers an offline scheduling problem of identical parallel machines where every machine is subject to at most one unavailability period. We assume that the jobs can be interrupted and resumed at any available machine. In other words, if a job is interrupted because of the unavailability of a machine it can be whether resumed at the same machine when it becomes available, or at any other available machine. The objective is to minimize the completion time of the last job (Cmax). The problem which can be represented as (P_m|r-a,pmtn|Cmax) is an Np-Hard problem. To solve this problem, we proposed a new method based on list scheduling techniques. In addition, we developed new theoretical lower and upper bounds. Then, we developed absolute performance bounds for the method. An absolute performance bound is a bound between the method's makespan and the optimal makespan for all possible instances of the problem. In addition, we formulated the studied problem as a mixed integer quadratic model that is sued to generate optimal solutions. Finally, we conducted an experimental study in which many instances of different sizes and parameters were generated and solved. The results proved that the new methods are performing very well for most of the tested instances.

**SF2.5 17:20** ***Using Six Sigma DMAIC Methodology to Develop a Facility Layout for a New Production Line***

Abeer Abualsaud (University of Sharjah, Saudi Arabia); Amna Alhosani and Aysha Youessf (University of Sharjah, United Arab Emirates); Fatimah Al Eid (University of Sharjah, Saudi Arabia); Imad Alsyouf (University of Sharjah, United Arab Emirates)

To have an efficient and effective production system, it's crucial to give special attention to the layout of the facility. The main aim of this study is to use the Six Sigma Define, Measure, Analyze, Improve, and Control (DMAIC) methodology to assess and improve the performance of an existing layout. Each phase will be discussed illustrating the basic engineering tools that will be used to achieve the project's objectives and identify the optimal layout design. The main results achieved were identifying the best layout design from four developed layout alternatives and choosing the optimal one that has the lowest cost and highest efficiency. In conclusion, by achieving the study objectives, we enhanced the working environment by applying facility planning tools to streamline the production processes and improve efficiency, performance and safety of the factory layout.

## SF3: Thermal and Fluid Systems 2

Room: Nadwa 1 5th Level

Chair: Wael M El-Medany (University Of Bahrain, Bahrain)

**SF3.1 16:00** ***Experimental and Numerical Setup for An Airfoil with Rotating Leading-Edge Cylinder Study***

Anfal Al-Abdullah and Muhammad Imran Qureshi (American University of Sharjah, United Arab Emirates)

In this study, a rotating cylinder has been embedded in the leading edge of a NACA0024 airfoil. The wing model has been analyzed experimentally as well as numerically. The airfoil was tested experimentally in a subsonic wind tunnel under different angles of attack α and cylinder-to-freestream velocity ratios ζ. The pressure distribution on the airfoil's surfaces has been observed, and flow visualization has been carried out to get a perspective on the behavior of the rotating cylinder. Additionally, a 2D numerical simulation using Computational Fluid Dynamics (CFD) has been carried out using ANSYS FLUENT software. It was set up to replicate the exact conditions of the experimental work. The simulation has been executed and validated successfully by the experimental data obtained. Furthermore, streamlines of the flow have been compared with the experimental photos. Both have shown a relevant outcome.

**SF3.2 16:20** ***1D and 2D Numerical Validation of Lee's Evaporation Model with OpenFoam***

Alladdine Achi (University BATNA 2, Algeria); Yassine Demagh (University of Batna 2, Algeria)

In the present study 1D Stefan evaporation and 2D film boiling problems will be studied numerically using the volume of fluid (VOF) method under OpenFOAM 2.4.0 CFD package. The mass transfer across the interface vapour/liquid is determined using the model of Lee. The results show excellent agreement for 1D Stefan evaporation problem compared to the exact solution. For 2D film boiling case, the obtained averaged Nusselt number presents a deviation about 19%, compared to the available correlations from the literature (Kleminko, 1981), which is consistent with previous research results. Through this validation, mathematic models and solver developed in this paper can be quickly applied to study phase change processes of interest.

**SF3.3 16:40** ***Design of a Geothermal Heating System***

Karthik Silaipillayarputhur (King Faisal University & College of Engineering, Saudi Arabia); Hassan Khurshid, Tawfiq Al Mughanam, Abdulateef Almudhafar and Abdullah Khalid Al Fozan (King Faisal University, Saudi Arabia)

The project work concentrates on the development of a geothermal residential heating system during cold winter. The available geothermal energy in Saudi Arabia was first studied. Thereafter, a suitable heat exchanger was developed to deliver the required heating requirements. In the development of the heat

exchanger, performance charts describing the performance of a parallel cross flow heat exchanger in terms of crucial dimensionless parameters were developed. Performance charts will readily help the heat exchanger designers in designing the most cost effective heat exchanger.

### SF3.4 17:00 *Design of Summer Air-conditioning System*

Karthik Silaipillayarputhur (King Faisal University & College of Engineering, Saudi Arabia); Hassan Khurshid, Tawfiq Al Mughanam, Nasser Al Khalifah, Abdullah Boudy and Ibrahim Allubly (King Faisal University, Saudi Arabia)

The project work concentrates on the development of a summer air conditioning system for the Mechanical Engineering wing in the College of Engineering building at King Faisal University, Kingdom of Saudi Arabia. A complete air conditioning system consists of the basic air conditioning system coupled with the refrigeration system and its associated pumping and cooling tower systems. In this paper, the development of the basic air conditioning system is considered. Therein, sensible and latent heat loads from various sources were evaluated in the mechanical engineering wing and a basic air conditioning system was developed. Based on mixing conditions, five different cases, were considered in this project. As a part of air conditioning system, the basic design of the cooling coil was developed. The cooling coil is a cross flow heat exchanger and it is assumed to be operating in counter cross flow configuration. Performance charts were developed for the counter cross flow heat exchanger in terms of meaningful dimensionless parameters. These charts will certainly help heat exchanger designers in developing the most cost efficient heat exchanger.

### SF3.5 17:20 *Numerical Analysis of an absorbing boundary Condition Applied to the Free Surface Water Waves Using the Method of Fundamental Solutions*

Mohamed Loukili (Sciences Faculty Ben M'sik University Hassan II Casablanca, Morocco)

In this paper, a meshless numerical wave tank (NWT) was proposed with new boundary conditions. Open boundary, partial reflection, and full reflection boundary condition. Using the method of fundamental solution of the Laplace equation as redial basic function (RBF), the problem is solved by collection of boundary points since governing equations are satisfied automatically. Our basic interest in this work is to extended new partial reflection from the open boundary condition, using the method of fundamental solutions

## SF4: Biomedical and Chemical Engineering

Room: Nadwa 2 5th Level

Chair: Hosni Ezuber (University of Bahrain, Bahrain)

### SF4.1 16:00 *Development and molecular modeling of VEGFR2 kinase protein with tetrazole based copper(II) & zinc(II) complexes*

Haleel Khan (Bahrain Training Institute, India & Ministry of Education, Bahrain)

An mononuclear metal(II) complexes of the type [M(L)(drug)]ClO4 [M = Cu(II) (1) & Zn(II) (2)] containing tetrazole core ligand have been synthesized and characterized by spectral methods. The geometry of complexes have been determined with the help of electronic absorption and EPR splitting patterns, which suggest five coordinated square pyramidal geometry around metal(II) ion. The complexes strongly interact with VEGFR2 kinase receptor via π-π, σ-π and hydrogen bonding interaction and forming a stable complex through covalent interactions like hydrophobic and van der Waals interactions, and the observed binding energy values are −24.04 & −9.41 kcal/mol for complexes 1 & 2, respectively.

### SF4.2 16:20 *Continuous Non-Invasive Blood Pressure Monitoring Device*

Njood AlZuabi (Imam Abdulrahman bin Faisal University, Saudi Arabia); Maysam AlFaddagh (Imam Abdulrahman Bin Faisal University, Saudi Arabia); Galyah AlHamid, Ghadah AlHamad and Ibrahim AlJamaan (Imam Abdulrahman bin Faisal University, Saudi Arabia)

Blood pressure is one of the most important parameters measured during surgeries and in vitally unstable patients due to its effect on other vital signs. Currently, the available and used measurement methods are limited to the oscillometric and arterial cannulation techniques, which have demonstrated great results for such purposes. However, each of those techniques has its disadvantages. The proposed design will attempt to eliminate these issues by measuring blood pressure non-invasively and continuously using an electrocardiogram sensor and two photoplethysmogram sensors. In this design, blood pressure is measured using Cattivelli's algorithm, which utilizes pulse transit time, heart rate, and coefficients that are obtained with calibration. Pulse transit time is calculated twice as the time between the R-peak in the electrocardiogram signal and the peaks of the two photoplethysmogram signals. For the development of the peak-detection and blood pressure estimation algorithms, medical signals of patients were acquired from MIMIC database to be processed in MATLAB, where the algorithms were developed. The blood pressure estimation algorithm, calibration and optimization methods need improvements and further testing. Nevertheless, this technology has significant potential for advancing healthcare.

### SF4.3 16:40 *A CFD Simulation for a Two-Phase Turbulent Bed Contactor*

Hadil Abu Khalifeh, Mohammad Alkhedher and Shannon Fernandes (Abu Dhabi University, United Arab Emirates)

Turbulent bed contactors (TBC) employed extensively in process industry and received much attention due to their high efficiency, and low capital and operating costs. In this paper, the bed hydrodynamics especially pressure drop is to be studied successively with the increase of superficial gas velocity in a TBC with different static bed heights, particle sizes, liquid flow rates and rheological liquid properties. A computational model capable of simulating hydrodynamic characteristics in a TBC at different operating conditions is constructed using ANSYS Fluent Software. The results of simulation are validated against experimental data obtained. As a first stage, the results of simulations for two phases (gas-solid) for the TBC are presented. Computed pressure drop is compared with experimental data. Good agreement between the two is found for different gas velocities. This study presents a new insight into design and operational parameters that may impact TBC efficiencies.

### SF4.4 17:00 *Two-Dimensional Numerical Study of Particle Motion for Continuous Focusing and Separation*

Alexandros Mantzanas, Nikos Dimitrioglou and Dimitris Hatziavramidis (National Technical University of Athens, Greece)

Hydrodynamic focusing devices are used for the counting and sorting of cells. Additionally they can have uses in the medical field such as in the encapsulation of pancreatic cell islets. Contrary to previous studies that simplify the problem by approximating the particles as a homogenous fluid entering the device we develop a model that analyzes them separately. More specifically we find their exact trajectory and rotational speed. This approach facilitates the study of the interaction between the particles themselves as well as with the device. The results of our simulation shed light on the dependence of the particle motion to the sheath to sample velocity ratio. These observations can facilitate the design and operation of a hydrodynamic focusing device.

### SF4.5 17:20 *Simple mathematical model for predicting anhydrite calcium sulfate scale deposition in brines*

Hosni Ezuber (University of Bahrain, Bahrain)

A simple and reliable method has been developed to predict the solubility of anhydrite calcium sulfate in NaClwater solutions over wide range of temperature (100-325oC) and pressure (up to 500 bar). The scaling tendency prediction model is based on sound literature experimental equilibrium solubility of anhydrite calcium sulfate in NaCl-water system under variable pressures and temperatures. The validity of the predictive method has been examined and compared to literature data and other related models, and the estimations of error in analysis has been presented. The predicted results are in basically conformity with literature solubilities which corroborate the suitability and applicability of the model. The predictive method is simple, easy to use and designed for environments where anhydrite calcium sulfate scale occurs.

# SF5: Modeling 3

Room: Nadwa 3 5th Level

Chair: Omar Al-Abbasi (University of Bahrain, Bahrain)

### SF5.1 16:00 *Determination of the Physical Properties and Geometric Shape of Objects Buried by Simulation Signals Radar GPR*

Gamil Alsharahi (Abdelmalek Essaadi University & Faculty of Sciences, Morocco); Aye mint mohamed Mostapha and Abdellah Driouach (Abdelmalek Essaâdi University, Morocco); Ahmed Faize (Mohammed 1st University, Morocco)

This paper aims at solving the problem of not knowing the physical properties and geometric shape of objects buried. In this work, we focus on the simulation of ground penetrating radar (GPR) signals to detect buried objects and determine the physical properties and geometric shape. This simulation was based on the FDTD method of electromagnetic wave analysis, which is the basis of GPR operation. GprMax was also used with the development in the code and improved to achieve the goal of this work. This work is one of a series of researches papers that have been published in previously indexed journals. We have obtained satisfactory and useful results through which we can determine the type of objects as conductors or dielectrics and also the geometric shape for these objects.

### SF5.2 16:20 *Substrate Temperature Optimization for Diamond Thin Film Synthesis using Hot-Filament Chemical Vapor Deposition*

Radhika Panickar (National Institute of Technology, Calicut, India); Choondal B Sobhan (National Institute of Technology Calicut, India); Sivaji Chakravorti (Jadavpur University, India)

Chemical vapor deposition is a versatile process for large area good quality thin film synthesis. Hot-filament Chemical Vapor Deposition (HFCVD) is one among the cost-effective methods that can produce good quality highly faceted polycrystalline diamond thin films. The physical parameters of the filaments, which are used to provide the activation energy, have a significant role in determining the temperature distribution and the gas density inside the reaction chamber. In the present work, the Finite Volume Method (FVM) is used to study the effect of the filament parameters of different grid filament configurations in optimizing the substrate temperature and determining the optimized filament parameters.

### SF5.3 16:40 *Transient CFD Modelling of a full cycle dead-end Ultrafiltration Membrane*

Omar Al-Abbasi and Mohamed Bin Shams (University of Bahrain, Bahrain)

This paper proposes a CFD model to predict and study the flux decline and concentration profile for industrialscale dead-end ultrafiltration (UF) membrane. This was achieved by solving the mass, momentum balances as well as the mass transport equation. The set of nonlinear partial differential equations were solved using finite element method. The model has been validated against experimental data available in the literature, and the results were in close agreement. The developed mechanistic model can be used to predict the reversible fouling of the membrane, the relationships between the operating variable, and could be used for modelbased control and optimization of large-scale UF system.

### SF5.4 17:00 *Thermo-economic Assessment and Multi-Objective Optimization of Vapour Compression Refrigeration System using Low GWP Refrigerants*

Ranendra Roy (Indian Institute of Engineering Science and Technology, Shibpur, India); Bijan Mandal (Bengal Engineering and Science University, India)

This paper deals with the thermo-economic analysis and multi-objective optimization of simple vapour compression refrigeration system using three low GWP refrigerants namely, R152a, R600a and R1234ze. A model has been developed in EES to analyze the system thermo-economically. Effect of evaporator and condenser temperature on COP, exergetic efficiency and annual plant cost rate has been evaluated. Predicted results show that refrigerant R152a shows the best performances among the investigated refrigerants. Results obtained with R600a and R1234ze are slightly lower than those with R152a. Multi-objective optimization has been carried out using the toolbox available in matlab to obtain the optimum solutions and TOPSIS decision making has been employed to get the optimum result. Optimum results also have pointed R152a to be the best refrigerant from thermodynamic and economic point of view.

### SF5.5 17:20 *An Optimization Approach to Selection of Intercity Rail Transportation Projects in Turkey*

Mustafa Hamurcu (University of Kirikkale, Turkey); Tamer Eren (Kırıkkale University, Turkey)

Transportation area are rapidly growing in the Turkey. There are more transportation projects different area such as bridge, highway, urban transport, rail systems and inter-city transport projects. High-speed rail and rapid train projects are one of these projects for intercity transport. Intercity transport is very important for people in terms of travel time and safe, are various projects in this area. The allocated budget to this area is finite; thus, integration, demand, population, regional development and budget limitations should be considered to choose the most valuable project in the best ranking. This paper investigates an application study from the high-speed rail and rapid train projects in Turkey to selection the most suitable projects for rail transport network. An application consists of planned high-speed rail projects and rapid train projects and the goal is to find the most suitable and the best advantage projects in Turkey. In this paper, it used analytic hierarchy process (AHP) to find the weight of the identified criteria for the rail systems in first step. Then it is presented a zero-one goal programming (ZOGP) model to optimize and schedule the implementation procedure on the project budget and special limitation. Finally, the best suitable projects are selected among the planned high-speed rail and rapid train projects with variety budget scenarios for intercity transportation.

# SF6: Software Systems

Room: Nadwa 4 5th Level

Chair: Mustafa Hammad (University of Bahrain, Bahrain)

### SF6.1 16:00 *Enhanced JPEG Algorithm for Colored Images Based on FPGA Implementation*

Mariam AlKandari (Kuwait University, Kuwait); Sa'ed Abed (Kuwait University & College of Computing Sciences and Engineering, Kuwait); Huda AlRasheedi and Imtiaz Ahmad (Kuwait University, Kuwait)

Image compression is an efficient method used to reduce the size of the image. JPEG algorithm has been considered as one of the famous techniques used for image compression. This paper proposed and implemented an optimized hardware solution called Hybrid Compression using Faster Color Conversion and Run Length (HC-FCC-RL) algorithm for JPEG algorithm based on FPGA to reduce the latency and accelerate the compression process. The paper also proposed a Fast Color Conversion with Approximation (FCCA) step to accelerate the conversion process from RGB to Y CbCr. Using approximate techniques will reduce the number of resources used as well as the latency with some percentage error. In addition, the paper proposed a Parallel Run Length (P-RL) algorithm to speed up the design. The enhancement approach in this paper aimed to optimize the overall design of the JPEG algorithm targeting color images. The HC-FCC-RL architecture was implemented in Verilog, synthesized on FPGA board and evaluated. The proposed work demonstrated superior performance compared to current work in the literature.

### SF6.2 16:20 *SPARQL2Hive: an approach to processing SPARQL queries on Hive based on meta-models*

Mouad Banane (University Hassan II, Morocco); Allae Erraissi (Hassan II University & Faculty of Sciences, Morocco); Abdessamad Belangour (University Hassan II, Morocco)

The growth of Web data has presented new challenges in terms of the ability to effectively query RDF data. Traditional relational database systems efficiently adapt and query distributed data. With the development of Hadoop, its implementation of the MapReduce Framework with Hive, a data warehouse, the semantics of data processing and querying has changed. We present in this article, SPARQL2Hive a competitive SPARQL Query Processing System on MapReduce that allows ad hoc SPARQL query processing on large RDF graphs. Instead of a direct mapping, SPARQL2Hive uses the query language of Hive, a data warehouse system that queries systems using HDFS, located above Hadoop MapReduce, as an intermediate layer between SPARQL and MapReduce. This additional level of abstraction makes our approach independent of the current version of Hadoop and thus ensures compatibility with future changes to the Hadoop framework as they will be covered by the underlying Hive layer. Our approach is to use the two meta-models of SPARQL and Hive, and propose a transformation between these two meta-models using the ATL language. We compare SPARQL2Hive with MapReduce-based SPARQL implementations

### SF6.3 16:40 *HVoR-Tree: Indexing Highest Order Voronoi Cells Using VoR-Tree*

Daraswati Zakirah (Telkom University, Indonesia); Kiki Maulana Adhinugraha (La Trobe University, Australia); Sultan Alamri (SEU, Saudi Arabia); Mohammed Aladalah (Monash University, Australia)

Index is a data structure to improve searching and minimizing effort to read the actual data. In spatial data structure, there are various objects can be considered, such as point, regular polygon, and irregular polygon. Irregular polygon is the shape of Voronoi Diagram which is used to divide a region into smaller regions based on its nearest neighbor. Voronoi Diagram has three orders, namely: (1) First Order Voronoi Diagram, (2) Higher Order Voronoi Diagram (HOVD), (3) Highest Order Voronoi Diagram (HSVD). Index uses Minimum Bounding Rectangle (MBR) in HSVD can cause high level of overlapping. The highest level of overlapping found in the HSVD, while the lowest is found in the First Order. VoR-tree (Voronoi R-Tree) is used to minimize overlapping. Previous studies used VoR-tree only to observed First Order Voronoi Diagram. This paper presents an index HVoR-Tree, which uses the VoR-tree structure effectively used in Highest Order Voronoi Diagram (HSVD).

### SF6.4 17:00 *A New Bearing Fault Diagnosis Method using Envelope based Feature Extraction*

Canan Tastimur (University of Firat, Turkey); Mehmet Karakose (Firat University, Turkey); Ilhan Aydin (Firat University & Faculty of Engineering, Turkey); Erhan Akin (Firat University, Turkey)

Asynchronous motors are the most used machines in industrial applications. Although these motors are generally reliable, many faults occur in these engines due to the environment and aging. The prediction of bearing failures is a necessary task in order to monitor the machine healthy. Because the bearings are vital for rotating machines. The time series produced by the vibration signals in the rotating machines can be examined to determine whether there is a fault in the machines or not. The performance of conventional intelligent diagnostic methods depends on the feature extraction of faulty signals. Feature extraction from defective signals requires signal processing techniques, expert knowledge, and human exertion. There are many methods developed for analyzing time series. In this study, a time series based classification technique was developed to detect malfunctions occurring in induction motors. The proposed algorithm only takes the vibration signals as input. The phase space of the vibration signals taken as input is generated according to the time delay and embedding dimension for each motor status. Each motor condition is divided into two classes: faulty and intact. After the envelope transform is enforced into each signal, phase space is obtained. Then Gaussian mixture model is formed. After with K-means clustering algorithm, the classification has been made up of four classes which are normal, outer race, inner race, and ball. The proposed approach has been tested on normal and defective vibration signals and results with high accuracy have been obtained.

### SF6.5 17:20 *Generating UML Use Case Models from Software Requirements Using Natural Language Processing*

Zahra AbdulKarim Hamza and Mustafa Hammad (University of Bahrain, Bahrain)

Modeling the system's specifications from the functionality perspective is an important step in analyzing the software requirements. UML use case diagram is one of the most used functional modeling techniques in the software development process. This paper provides an approach to generate the UML use case diagrams from the requirements text using natural language processing. The approach consists of several steps to process the requirements text. Starting with filtering the text from the mistakes and going through natural language processes till generating the use case diagrams. Experimental evaluations have been done on several public software projects to demonstrate the accuracy of the proposed approach.

## Wednesday, April 17

## Wednesday, April 17 8:30 - 9:00

### Registration Day-3

## Wednesday, April 17 9:00 - 10:20

### SG1: Materials and Composites

Room: Al Majlis 4th Level

Chair: Srinivasan Murugan (Dhofar University, Oman)

### SG1.1 9:00 *Multiple Response Optimization Of Friction Stir Processing Aluminium Alloy Using Response Surface Methodology And Grey Relation Analysis*

Srinivasan Murugan and Tofayel Ahmed (Dhofar University, Oman)

This study aimed at multiple response optimization for the process parameters during friction stir processing (FSP) of Al6061 aluminium alloy plate using response surface methodology and grey relation analysis. The experiments are conducted by varying the process parameter namely tool profile, tool rotation speed and tool feed. The process parameters are devised to optimize the ultimate tensile strength (UTS) and elongation percentage (EL%). The design of experiment is adopted based on the response surface methodology (RSM) randomized central composite design (CCD) using Design Expert11 software. The grey relation analysis (GRA) is used to optimize the multi response into a single objective by evaluating the process parameters using grey relation grade (GRG). The optimum process parameters are obtained based on GRG and a validation test is conducted to the confirm the findings. The experimental findings have depicted that the responses of friction stir processing can be enhanced by the integrated approach.

### SG1.2 9:20 *GFRP Composite Drilling Parameters Optimization*

Ranjan Kumar Ghadai and Kanak Kalita (Indian Institute of Engineering Science and Technology, Shibpur, India)

In this article, a genetic algorithm (GA) is used for optimizing an empirical model of surface roughness in drilling Glass-fibre reinforced plastic (GFRP) composites. It is assumed that the roughness of the drilled surface is a function of drilling parameters- material thickness (t), spindle speed (N), feed rate (f) and drill diameter (D). A response surface methodology (RSM) based three levels (-1, 0, 1) design of experiments is used for developing the empirical model. Analysis of variance (ANOVA) is undertaken to determine the importance of each process parameter in the developed model. Subsequently, after detailed model adequacy checks, the insignificant terms are dropped to make the established model more rigorous and make accurate predictions. A sensitivity analysis of the independent variables on the output response helps in determining the most influential parameters. It is observed that feed rate (f) is the most crucial parameter, followed by the material thickness (t) and drill diameter (D). The optimization results depict that the roughness of the drilled surface increases as the feed rate increases and a minor value of drill diameter is the most appropriate to attain minimum surface roughness.

### SG1.3 9:40 *Thermal Analysis in Laser Surface Alloying of Ti6Al4V with TiC*

Avanish Dubey (Motilal Nehru National Institute of Technology, India); Anas Siddiqui (41/8A Rajrooppur, India)

Laser Surface Alloying employs high laser power density to melt alloying material and a portion of the underlying substrate to form an alloyed layer over substrate. As melting temperature of Ti alloys is very high, it poses difficulty in alloying using conventional methods. Titanium alloys are vulnerable to induced thermal stresses at high temperature. In this study thermal analysis of laser surface alloyed Ti6Al4V with TiC at different laser power and laser spot diameter is modelled. Melt pool depth and developed thermal stresses at different process parameters are predicted. Subsequently, model is verified with published experimental results. It is observed that developed model is adequate in predicting pool depth with 6.43% error. The von-Mises stress is observed to be lower than the yield strength of the material, indicating less possibility of thermally induced cracks.

### SG1.4 10:00 *Numerical Study of Laser Hole Cutting in Zirconia Toughened Alumina Plate*

Avanish Dubey and Surendra Saini (Motilal Nehru National Institute of Technology, India)

The main cause of cracks formation in laser cut holes is due to thermal stress. These formed cracks alter the mechanical properties of work material and degrade the cut hole quality. Therefore thermal analysis of laser cut holes become essential. Laser cutting of structural ceramic possess extra constraints due to their brittle nature. In present paper, laser cutting of hole in Zirconia Toughened Alumina ceramic plate is simulated to investigate the temperature and stress profile. The numerically predicted results show that maximum temperature of 3300 °C is developed near the cut hole region whereas maximum stress of 5 GPa is observed.

## SG2: Artificial Intelligence

Room: Al Marsa 4th Level

Chair: Abdul Fattah Salman (University of Bahrain, Bahrain)

### SG2.1 9:00 *An Edge-Based Algorithm for Solving the Right Partner Problem*

Abdul Fattah Salman, Abdulla Alqaddoumi, Youssef Harrath and Adeela Mohammad (University of Bahrain, Bahrain)

The essence of the right partner problem is to pair people together based on their preferences of likes and dislikes towards other people. It can be considered as a special case of matching problem, assignment problem with some similarities to the grouping problem. In the right partner and grouping problems, people are paired/grouped together from one set, whereas in the other problems, groups are formed from two disjoint sets. In this research, the authors propose a new algorithm that satisfies most of the preferences based on an undirected weighted graph. The produced results are compared to those of the already existing novel graph-based algorithm. Both algorithms are implemented and tested under several scenarios using the same data instances. Based on the produced results, it is concluded that the edge-based algorithm outperforms the novel graph-based algorithm.

### SG2.2 9:20 *A Model Order Reduction Technique Based on Balanced Truncation Method and Artificial Neural Networks*

Mohamad Baziyad, Anwar Hasan Jarndal and Maamar Bettayeb (University of Sharjah, United Arab Emirates)

This paper presents a framework for model order reduction based on Balanced Truncation (BT) method and Artificial Neural Networks (ANN). As social, architectural and technical models are witnessing rapid complexity increase, it has become essential to find solutions to obtain a lower complex version of models while still preserving the model integrity. The main idea of the proposed framework is to reduce uncertainty by cascading two different Model Order Reduction (MOR) approaches, the BT technique and the Jordan Recurrent Neural Network (JRNN). The reduced model obtained by the JRNN network is estimated using the Instrument Variable (IV) estimation approach. Finally, the BT reduced model and the estimated JRNN reduced model are cascaded to obtain the final reduced order versions of the original plant. The cascading procedure takes the powerfulness of both techniques and present them in a single system capable to compensate for possible errors and uncertainties. Simulation results prove the efficiency of the proposed framework in terms of the deduction strength and the integrity level.

### SG2.3 9:40 *Comparison of Support Vector Machine, Artificial Neural Networks and Spectral Angle Mapper Classifiers on Fused Hyperspectral Data for Improved LULC Classification*

Stalin Subbiah (Bahrain Training Institute, Bahrain)

The present paper focuses on analyzing the performance of three different advanced classifiers on hyperspectral data for improved land use/land cover classification. Considering the limitations of spatial and spectral resolution of high resolution multispectral and hyperspectral datasets, image fusion techniques were used for obtaining a spectrally and spatially rich space borne hyperspectral data. The Gram Schmidt sharpening, Principal Component sharpening and Color Normalized spectral sharpening were used for fusing the 30m, 242 band EO-1 Hyperion image with the 1.8m eight band World View 2 data. Correlation,

SNR and entropy measures were adopted for analyzing the performance of the fused outputs. Color Normalized spectral sharpening was observed to exhibit highest correlation of 0.78 between spectra of Hyperion and fused images. Classification of the fused and unfused images was performed using three different classifiers - Spectral Angle Mapper, Artificial Neural Networks and Support Vector Machine by taking end members from the image and the ground spectra. Confusion matrix was generated using a ground truth points obtained during field visit. Support Vector Machine classifier with RBF kernel and 100 penalty value was observed to give an improved classified output than the remaining classifiers with an accuracy of 89.56% and a kappa coefficient of 0.88%.

### SG2.4 10:00 *A Survey of Applications of Artificial Neural Networks in Wireless Sensor Networks*

Farouq Muhammad Aliyu and Sani Umar (King Fahd University of Petroleum and Minerals, Saudi Arabia); Hussain Al-Duwaish (King Fahd University of Petroleum & Minerals, Saudi Arabia)

Wireless Sensor Network (WSN) is the network nodes with limited resources such as energy, memory and processing power used in sensing an environment. WSNs are known for gathering a large amount of data from the environment. Time, accuracy and proper interpretation of data obtain is of paramount importance. This led some scientists to propose the application of artificial intelligence (AI) techniques in WSN. One AI technique that is widely proposed by researchers is Artificial Neural Networks (ANNs). This is because ANN is applicable to non-linear systems, fault tolerant and adaptive to variation in information. However, ANN is a computationally intensive technique while WSN nodes typically have limited resources and this makes their marriage a challenging one. This paper investigates the techniques used by researchers in deploying ANN in WSN. The paper is limited to applications of ANN in WSN's application layer.

## SG3: Computer Engineering 2

Room: Nadwa 1 5th Level

Chair: Alauddin Yousif Al-Omary (University of Bahrain & University of Bahrain, Bahrain)

### SG3.1 9:00 *People and Mobile Computing: Architecture and Concerns*

Omar Abahussain and Fawzi Albalooshi (University of Bahrain, Bahrain)

This research aims to show the importance of the mobile computing and its impact on people. The paper discusses the architecture and forms of mobile computing. The paper proposes educating people in knowing the risks of mobile computing and the bad practices that should be avoided. As technology advances, risks increase if left unresolved nor the people are unaware of ongoing risks.

### SG3.2 9:20 *A Centralized Multi-Floor Indoor Navigation System for a Smart Buildings*

Noora Alsabbagh (University of Bahrain, Bahrain); Alauddin Yousif Al-Omary (University of Bahrain & University of Bahrain, Bahrain)

In this paper, a new Indoor Positioning System (IPS) is introduced. The IPS allows people to navigate in an indoor environment such as malls, public buildings, hospitals and airports where GPS cannot be used due to accuracy problem. The proposed system addresses the multiple floor localization, which is not addressed carefully by researches. The system can recognize the user position across multiple floors, using the Wi-Fi Received Signal Strength Indicator (RSSI) and a smartphone barometer sensor to construct the indoor environment radio map. The system is to be implemented and tested at Seef mall Arad in the Kingdom of Bahrain. Such new applications will enrich the quality of life and help in converting our buildings and city to smart building and smart city.

### SG3.3 9:40 *Promoting Cyber Security Architecture to Mitigate Cyber Threat*

Theyab Alrubaie (University of Bahrain, Bahrain)

Shamoon attacks one of the most recently advanced persistent threat (ATP) attacks targeting Saudi Arabia. The paper will give a critical analysis of the historical, technical aspect and tactics of the Shamoon attacks that targeted several organizations in Saudi Arabia. We will address the attacks methods and stages of the attackers implement the penetration. This paper exposes weaknesses in the cyber security architecture that exploited by the Shamoon attackers. In this research, we will analyze the Shamoon attacks and find the enhance cyber security architecture that helps to kill the chain of attack at any stage to mitigate Shamoon destructive attacks.

### SG3.4 10:00 *Solutions to address the security issues of IoT-based smart grid networks*

Khalid M. Shaheen (University of Bahrain, Bahrain)

Smart Grid (SG) is the modern power system, is development and integrates the power grids with the Information and Communication Technology (ICT) to ensure reliable and safe power deliver to the customers. SG allows smart devices and smart meters to exchange information with power utilities. The Advanced Metering Infrastructure (AMI) acts as the communication center to connect with the smart grid, the most common component in smart grid applications. The Internet of things (IoT) is a set of devices that contain electronics, software, sensors, actuators, and connectivity that enable the connection and transmit data. (IoT) has developed as one of the technologies that make a smart grid network to be possible. The main challenges of IoT is security and how to protect smart grid and the devices that connected over a network from the cyber-attack. Cyber-attack on a smart grid can cause interruption on reliability of infrastructure and shutting down the electricity grid. Once a one device is compromised, then the entire grid can be susceptible to cyber-attacks. Due to this, the security became a serious factor we must pay attention to implement the IoT based smart grid networks. In this paper we review and explore the major security issues of IoT-based smart grid networks and the solutions to mitigate the impact of attack on IoT-based smart grid.

## SG4: Electrical Engineering 2

Room: Nadwa 2 5th Level

Chair: Sarah Al-Shareeda (University of Bahrain, Bahrain)

### SG4.1 9:00 *Design of Power System Stabilizer Using Phase Based Objective Function and Heuristic Algorithm*

Mohamed Hassan (KFUPM, Saudi Arabia); Mohamed Hassan. (King Fahd University of Petroleum & Minerals, Saudi Arabia); Mohammad A. Abido and Abdulrahman Aliyu (KFUPM, Saudi Arabia)

This paper proposes a novel objective function based on power system exciter frequency response to design robust power system stabilizer (PSS) using heuristic optimization techniques, in order to damp the electromechanical oscillations at very low frequencies (0.1-3 Hz), that often tend to grow with time and cause system instability. The new objective function comes from the fact that the generated electrical torque must be in phase with the rotor speed deviation in order to get the optimal damping, thus by considering the arithmetic summation of the exciter and the PSS phases to be approximately zero in the desired frequency range, a new objective function can be defined. A Single Machine Infinite Bus (SMIB) system is considered in this study and the conventional lead-lag controller is designed based on the new objective function and Differential Evolution optimization algorithm. Several excitation and PSS models are simulated to test the effectiveness of the proposed method which is found to be satisfactory

### SG4.2 9:20 *Wind-Fuel-Cell-Solar Hybrid Electric Boat Power Design with MPPT System*

Walid Obaid (UOS, United Arab Emirates); Abdul-Kadir Hamid and Chaouki Ghenai (University of Sharjah, United Arab Emirates)

An electric boat hybrid power system design is proposed. The system uses a wind turbine that is driving an induction generator as the first renewable energy power source, solar PV panels with Maximum Power Point Tracking (MPPT) system as the second renewable energy power source, and polymer electrolyte membrane (PEM) fuel cell for the third renewable energy power source. The hybrid power system is used to drive the AC motor for the electric boat. Circuit breaker blocks are used to switch between using wind turbine and other renewable sources to operate the boat based on wind speed. The proposed system which has three elements is simulated using SIMULINK. The simulation results will be demonstrated to show the continuous operation of the electric boat regardless the changes in weather conditions such as solar irradiance and wind speed.

### SG4.3 9:40 *Constant Current Fuzzy Logic Controller for Grid Connected Electric Vehicle Charging*

Hammed Olabisi Omotoso, Saad Alghuwainem and Irfan Ahmad (King Saud University, Saudi Arabia)

The increase in demand for clean sources of energy is getting more attention in recent time. Electric vehicle (EV) is an important area to fulfil this demand. However, one of the major obstacles in the growth of EV is the longer charging time. Therefore, there is a definite need for the reduction of charging time in EVs. Constant current charging of EV can help to solve this problem. That's why, the role of DC-DC converter is very important. DC-DC converters are commonly utilized in electronic devices such as mobile phones, computers etc. This paper presents the possibility of grid connected constant current charging of EV with buck DC-DC converter through modern fuzzy logic control (FLC). FLC is easy to implement without requirement of intensive mathematical modelling. The complete model of the considered system has been developed in MATLAB/Simulink. The achieved simulation results show the viability and capability of the proposed scheme.

### SG4.4 10:00 *Application of RC5 for IoT devices in Smart Transportation System*

Nawal Alsaffar (University of Bahrain, Bahrain); Wael M El-Medany (University Of Bahrain, Bahrain); Hayat Mohamed Abdulla Ali (, Bahrain)

Nowadays Internet of Thing (IoT) technology has accessed all the aspects of our life. One of the IoT applications is the smart transportation. Smart transportation gains a lot of attention, as it is part of the smart cities. The data transmission in smart transportation is done through the wireless communication and especially through the Vehicular ad hoc networks (VANETs) which made the data vulnerable to many issues concerning security. Therefore, security techniques should be applied to secure vehicle's user data. In this paper, the RC5 encryption algorithm will be used as a security technique to protect users' privacy in smart transportation. The simulation and optimization of RC5 will be implemented with FPGA using Quartus Prime Lite Edition version 18. The purpose is to reduce hardware resources of RC5 and make it suitable for smart transportation.

## SG5: Mechanical Engineering & Applied Mathematics

Room: Nadwa 3 5th Level

Chair: Hatem Masri (Sakheer Campus, Bahrain & University of Sousse, Tunisia)

### SG5.1 9:00 *Wearable vibration based hybrid energy harvester for wearable devices*

Iftikhar Ahmad, Ahmed Abdelrhman, Christina Georgantopoulou, Syed Imam and Sam Najat (Bahrain Polytechnic, Bahrain)

Wearable devices are used in human health monitoring and their demand is increasing day by day. The limited shelf life of the batteries in these devices is one of the main problems. Research is going on either to increase the battery life or to replace the battery with some alternatives. In this research, a vibration based hybrid energy harvester has been illustrated to overcome the power problem of the wearable devices. The piezoelectric and electromagnetic transduction mechanisms are used to develop a hybrid mechanism for the enhanced output voltage. Two piezoelectric beams with wound coils have been fixed in 3D printed spacers to yields a prototype having the total volume of 10.8 cm3. The prototype can generate a maximum open circuit voltage of 1640 mV at a very low vibration level of 1.5 g which proves that the device is suitable for low vibration environment such as human body vibration.

### SG5.2 9:20 *Modeling, Simulation and Performance Analysis of Solar PV Integrated with Reverse Osmosis Water Treatment Unit for Agriculture Farming*

Chaouki Ghenai, Aya Almasri, Jumana Alrejjal and Nour Khalil (University of Sharjah, United Arab Emirates)

A design model for sustainable and clean power system integrated with reverse osmosis water treatment/desalination unit to meet the challenges of climate change, water shortage and energy while producing organic and healthy food is presented in this study. The main objectives of the optimized design of renewable power system are: (1) decrease the $CO_2$ emissions, (2) reduce the energy consumption from the grid and increase the penetration of renewable resources (solar) in the energy mix, and (3) fresh water production for irrigation using underground or sea water reverse osmosis water treatment/desalination system. The goal is to develop sustainable energy and water systems to meet the challenges of climate change and water shortages especially in desert regions. Modeling, simulation, optimization and control strategies are used in this study for the design of off-grid and grid-tied solar PV integrated with water treatment system for agriculture farm. The results show that the grid-tied solar PV power system offers the best performance for the agriculture farm with respect to the cost (85$/MWh), renewable fraction (penetration of renewables in the energy mix - 67%), and greenhouse gas emissions reductions (208 kg $CO_2$/MWh).

### SG5.3 9:40 *Ultrasonic Monitoring of Hardness of Industrial Rubbers*

Subhasis Mondal and Debasis Datta (Indian Institute of Engineering Science and Technology Shibpur, India)

Ultrasonic testing is normally known to be a very useful Non-Destructive Testing (NDT) method for detecting defects in materials. In recent years, NDT methods are very much in practice and act as a powerful technique for inspecting and measuring various properties of engineering materials. This paper is based on the interaction between characteristics of ultrasonic waves and rubber hardness. An Ultrasonic NDT set-up was developed in-house for recording digitized ultrasonic data in real time. A transmitting as well as receiving transducer with a central frequency of 1 MHz was used during the experiments to generate and capture longitudinal pulse for both natural and synthetic rubbers, having different shore hardnesses ranging from 55 to 85. It was found that the ultrasonic velocity was not only sensitive to hardness of rubbers, but also to temperatures. The set-up was specially furnished with temperature controllers for calculating ultrasonic velocity in rubber samples at different temperatures. Dependence of ultrasonic wave velocities with hardness and temperatures were studied from experimental observations. Acoustic impedance, reflection, and transmission coefficients were also calculated for explaining the behavior of ultrasonic waves in normal mode.

### SG5.4 10:00 *Optimal time frame required to accurately estimate Ktrans,vp and ve using graphical method: Simulation Study*

Habib Ebrahim Ashoor (University Of Bahrain, Bahrain)

Graphical methods (GM), based on analysing data derived from tracer passages, are robust tool used to estimate the descriptive parameters related to a microvasculature. These parameters known as: fractional plasma volume (vp), transfer constant (Ktrans), total distribution volume (vD). This study examines the time frame at which these methods can produce more accurate results. To do so sets of uptake tissue curves (Ct) were simulated by using approximation to the

tissue homogeneity model (AATH) and the arterial input function (Cp) is constructed by adding three Gamma-variant. The tissue uptake curve is divided into five time frames, as follows: initial time to AIF's peak [t0, tp], AIF's peak to AIF's first pass [tp, tfp], first time passage [t0, tfp], at equilibrium teq, initial time to equilibrium [t0, teq], and initial time to washout time [t0, tf]. The study revealed that care should be taken in using GM during the bolus passages; more accurate Ktrans estimates can be determined more accurately from the initial data obtained from the first passage of the bolus within the time frames [t0, tp] and [tp, tfp]. Contrary to expectation, the unidirectional model decline to measure vp. On the other hand, the bidirectional is success to estimate vD more accurately within the time frame [tfp, tf].

# Wednesday, April 17 10:20 - 10:40

## Coffee Break

# Wednesday, April 17 10:40 - 12:40

## W1: Business Analytics

**Sue Merchant - INFORMS, USA**

Room: Al Majlis 4th Level

## W2: Supply Chain Optimization

**Fouad Ben Abdelaziz - NEOMA BS, France**

Room: Al Marsa 4th Level

## W3: Quantitative Research Methods

**Nada Mujahid Ibrahim  University of Bahrain, Bahrain, Bahrain**

Room: Nadwa 1 5th Level

## W4: Financial Modeling

**Sabri Boubaker - Champagne School of Management, France**

Room: Nadwa 2 5th Level

# Wednesday, April 17 12:40 - 13:00

## Closing Session and Closing Remarks

# Wednesday, April 17 13:00 - 14:00

## Networking and Lunch Break