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ABSTRACTS FOR ORAL PRESENTATION

Active tendon control of tensegrity structures

Nabil Ben Kahla and Mohamed Hechmi Elouni
Civil Engineering Department, College of Engineering, King Khalid University, Abha-Kingdom of Saudi Arabia
nbohlal@kku.edu.sa

Abstract

"Tensegrity" systems are lightweight freestanding space pin-jointed structures made up of a network of continuous tensile elements (cables) and "discontinuous" compressive components (struts). They have in general low structural damping, leading to challenges with respect to vibrations induced by wind, traffic or even earthquakes which may affect the serviceability and occupant comfort, and cause structural damage and even failure. Vibrations may be reduced by passive, active, semi-active and hybrid strategies.

This paper investigates the nonlinear control of tensegrity systems. The active tendon control is adopted to attenuate vibration amplitudes and to solve instability problems associated with tensegrity dynamics. This strategy uses pairs of displacement actuator and force sensor, collocated at the lower end of strings and/or struts. A control strategy based on decentralized collocated integral force feedback is employed. A geometric nonlinear dynamic procedure is then used for the analysis of the response of the structure with and without active control. An incremental-iterative solution based on a Newmark direct integration method and a modified Newton–Raphson scheme is adopted for solving the nonlinear equation of motion. This strategy is successfully applied on various types of tensegrity systems: a tripod Simplex, a Geiger's dome and a tensegrity bridge.

Keywords: Tensegrity, vibration, active tendon, stability, Geiger's dome, Tensegrity bridge

Nano-engineered novel flat panel display technology.

Mohammed Zubair Mohammed Shamim

Electrical Engineering Department, College of Engineering, King Khalid University, Abha-Kingdom of Saudi Arabia

mzmohammad@kku.edu.sa

Abstract

Flat panel display industry is one of the most prominent technologies in today's market. The market is estimated to be around $100bn and growing. Liquid crystal display (LCD) technology has mostly resolved the most of the display problems and is currently the dominant mass market consumer display. However, LCD technology has some limitations such as low contrast levels (due to backlight) that are evident for certain applications such as true video rendering of images. New emissive display technologies such organic light emitting diodes (OLED) are making inroads, however they too suffer from issues such as screen burn-in and degradation in light output over period of time. Unfortunately all of these require new manufacturing process and systems preventing manufacturers from making the technology commercially viable. The holy-grail for field emission displays (FED) is to use existing manufacturing processes and materials. Field emission from silicon Spindt-tips usually involve complex photolithography process, thereby making the technology expensive to be commercially viable. Research in using laser annealed planar silicon cold cathode emitters has shown that planar silicon has the potential to become the desired material for field emission displays. The research carried out here, focuses on, characterising these planar silicon emitters by studying their surface morphology, optical and electronic properties, develop prototypes and drive them using bespoke designed driver electronics. Excimer laser crystallisation and aluminium induced crystallisation have been extensively used to create similar emitting characteristics to silicon Spindt-tips without having to perform any complex photolithography.

Keywords: Hydrogenated Amorphous Silicon, Nanostructures, Field Emission, Flat Panel Displays.

A genetic algorithm approach for solving the daily photograph selection problem of the SPOT5 satellite

Mohamed A.A. Mansour and Maged M. Dessouky
Industrial Engineering Department, College of Engineering, King Khalid University, Abha-Kingdom of Saudi Arabia.
momansor@kku.edu.sa

Abstract

This article addresses the combinatorial optimization problem of managing earth observation satellites (EOSs) such as the French SPOT5, which is concerned with selecting on each day a subset of a set of candidate photographs. The problem has a significant economic importance due to its high initial investment cost that exists in these instruments and its solution difficulty resulting from the large solution space, making it an attractive research area. This article proposes a genetic algorithm (GA) for solving the SPOT5 selection problem using a new genome representation for maximizing not only a single objective as profit but a multi-criteria objective that includes the number of acquired photographs. Test results of our proposed GA show that it finds optimal solutions effectively for moderate size problems and obtains better results for two large benchmark instances coded 1403 and 1504 in the literature. Also, we verify the result that the best known value in the literature for problem coded 1401 is an optimal value.

State of the Art: Engineering Aspects of Nano-Catalysis for Selected Fertilizer Industries

Yasser M. Fahmy
Chemical Engineering Department, College of Engineering, King Khalid University, Abha-Kingdom of Saudi Arabia
yamahmoud@kku.edu.sa

Abstract

Nanocatalysis is a rapidly growing field which involves the use of nanomaterials as catalysts for a variety of homogeneous and heterogeneous catalysis applications. Generally nanocatalysts are defined as nanoscale materials that have at least one nanoscale dimension, or have been subjected to nanoscale structural modification in order to enhance their catalytic activity. They could be classified into four distinct types of catalysts: nanoparticulate, nanoporous, nanocrystalline, and supramolecular catalysts.

The present state of the art focuses on the engineering aspects of nano-catalysis for selected fertilizer industries. The state of the art shall be organized into eight sections. The first section starts with a brief introduction, and then follows with a list of nanocatalysts synthesis methods and description of selected synthesis techniques. Section three describes the characterization of structured nanocatalysts. Section four demonstrates nanocatalysis scale up including hightroughput screening and experimentation followed by comparison with the six flow reactor. Section five describes the kinetic of nanocatalysis. Section six demonstrates the process intensification and microreactor. Section seven discusses the nanocatalysts manufacturing and economic impact. Section eight focuses on nano-catalysis application especially nitrogen fertilizer industries based on ammonia manufacturing as the case study including comparison between ammonia synthesis using classical catalysts and nanocatalysts.

Effect of Squeeze Casting on Wear Characteristics of Precipitation Hardened Al-Alloy-$Al_2O_3(TiO_2)$ Hybrid Metal Matrix Composites

Vineet Tirth

Mechanical Engineering Department, College of Engineering, King Khalid University, Kingdom of Saudi Arabia
vtirth@kku.edu.sa

Abstract

AA2218–Al2O3(TiO2) composites were synthesized by stirring 5 wt% of ball milled 1:2 mixture of Al2O3:TiO2 powders in molten AA2218 alloy before squeeze casting at pressures from 0 (gravity cast) to 220 MPa. The composites were given T61 precipitation heat treatment and characterized by the microstructure and hardness. The microstructure of the composites changes with increase in squeeze pressure. SEM microstructures of the composites and worn surfaces are studied and discussed in correlation with wear properties. Dendrite cell size reduces and hardness increases with increase in squeeze pressure. Dry sliding wear tests were conducted on pin-on-disc set-up at normal loads of 4.9 N to 13.24 N and fixed sliding speed of 1.26 m/s up to total sliding distance of 3770 m. The volume loss during dry sliding wear increases linearly with increasing sliding distance but composites cast at higher squeeze pressure show relatively lower volume loss. There is a decrease in volume loss in T61 aged squeeze cast composites with increasing squeeze pressure, more so between squeeze pressure of 140 and 160 MPa.

Wear rate decreases in peak aged squeeze cast AA2218-5 wt% Al2O3(TiO2) composites with increasing squeeze pressure. Marginal decrease in wear rate is observed in composites cast at squeeze pressure up to 140 MPa but there is quite substantial decrease in wear rate in composite squeeze cast at 180 MPa, beyond which, the wear rate decreases again marginally.

In the range of normal load and sliding speed employed in the dry sliding wear test of the composites and the matrix alloy, the wear is primarily oxidative. The metallic chips are present in the wear debris, which may have resulted from micro-cutting by the asperities of counter-face in a three-body wear situation. There is extensive formation of transfer layer on the sliding surface of the composites and alloys by compaction of wear debris. The wear coefficient of AA2218-5 wt% Al2O3(TiO2) composites increases with increasing squeeze pressure except for the marginal decrease between 200 and 220 MPa, giving an indication that wear resistance decreases with increasing squeeze pressure. But this would be an erroneous conclusion as evident from steadily decreasing wear rate with increasing squeeze pressure. Thus, it is found in this study that wear coefficient is an indicator for wear measurement when the wear mechanism is purely adhesive as explained in Archard's law but for mixed wear mechanism, wear rate is found to be a more reliable indicator for the three-body wear of composites.

Keywords: Dry sliding wear; Squeeze casting, Hardness, Metal Matrix Composites.

Knowledge Capture and Retrieval In Engineering Projectized Organisations

Ibrahim I. Falqi

Civil Engineering Department, College of Engineering, King Khalid University, Abha-Kingdom of Saudi Arabia
ifalqi@kku.edu.sa

Abstract:

During engineering projects, which can be highly knowledge-intensive, a considerable amount of new knowledge is created and remains in people's heads. Unless it is captured and transformed into collective explicit knowledge it will be lost. However, knowledge capture and retrieval suffers from a number of deficiencies, which may result in the loss of huge amount of knowledge and difficulties in retrieving captured knowledge. This study aims to develop a reliable framework for the capture and retrieval of project management knowledge for use in Engineering projects.

Adopting an empiricist methodology, it includes a survey conducted to investigate the current practice, and semi-structured interviews to explore best practice. The results obtained are used as a foundation for a framework that can assist engineering companies to avoid the loss of project knowledge and increase performance and innovation in projects.

The findings indicate that project review (PR) is the most appropriate method for achieving knowledge capture; in addition, this should be conducted in a systematic and precise way and results should be presented in the form of instructions or in a checklist format, forming short and precise insights. For quick and efficient retrieval knowledge must be categorised based on project management processes and activities, using an IT system with components designed to manage knowledge and locate experts. Nevertheless; the framework developed suggested that regardless of the effectiveness of the approach to knowledge capture and retrieval, without a knowledge-sharing environment the application will not benefit from these methods. Open culture and resources are critical for providing a knowledge-sharing environment and that leadership has to sustain project knowledge capture and retrieval, providing full support for its application. The framework has been evaluated by academics and practitioners who are experts in their field. The results have indicated that the framework and its components are both applicable and effective.

Keywords: Learning Organisation, Project Knowledge, Knowledge Management, Project Review, Knowledge Capture, Knowledge Retrieval, Community of Practice

ABSTRACTS FOR POSTER PRESENTATION

Architecture and Urban Planning Department

Application of Bio-climatic Design in Energy Efficient Architecture

Farhat Ali

Bioclimatology research is a study about the climate for human comfort. The bioclimatic design is a method where it's get benefitted by design elements and building technology to control the heat transfer process. As a result, its create the comfortable condition fir its inhabitants and save the energy of the building. Therefore, bioclimatic work on the principles of local climate features with many applications of passive strategies related to this building which rarely include mechanical application Therefore, the bioclimatic design differentiates itself from what is called sustainable design. It's very economic as we are depending upon the natural resources for the bioclimatic design of building.

Role of Green Building & Technology in Architecture

Farhat Ali

During the last 35-40 years we have been facing the bad experience of global warming, Ozone depletion, energy shortage, resource reduction, , ecological disparity and acid rains etc. These situations are warning us to minimize the cause which is affecting the environment, the research on Green buildings will aim and contribute towards reducing the environmental issues. This research will include the benefits of green building and process of involving green materials and techniques to promote Green Architecture. Green buildings do not only contribute towards a sustainable construction and environment but it also brings lots of benefits to the building owners and the users. It contributes towards lesser development costs, lesser operating costs, healthier indoor environment quality, improved comforts and enhanced durability etc.

Application of Nanotechnology in Architecture and Building Construction

Farhat Ali

In the present scenario, the architecture is a discipline which deals with many engineering's fields i.e. civil, mechanical & electrical. The main application of Architecture can be seen in space design, functions, and building construction. Nanotechnology research over new innovative building materials and construction techniques. Its uses very small particles of materials in nanometer which affect the property of materials. The Architecture & building construction business will inevitably be a beneficiary of this nanotechnology. This technology increased strength and durability of materials which reduce the environmental footprint of the built environment by the efficient use of resources. It is a supporting technology that allows us to improved materials with developed or absolutely new properties.

Chemical Engineering Department

What went wrong: Lessons learned from Tianjin Port Explosion in China

Muhammad Arshad

This paper studies the impact of fire and explosion incident in Ruhai's Logistics International Co., at Tianjin Port, China. Unsafe handling of nitrocellulose supplies resulted in volatilization of its ethanol wetting agent from damaged packaging material and gave rise to spontaneous combustion. This caused spreading of fire to nearby several containers of various hazardous materials and bulk storage of ammonium nitrate, some of them stored beyond permissible limits and stacked in the same area leading to two massive explosions equivalent to 15 and 430 tons of Trinitrotoluene (TNT). Investigation revealed noncompliance of the safety regulations by the management of warehouse and relevant government officials alike contributed to the failure of safety system. The total direct economic losses are estimated to be $2 billion. It is expected that Tianjin Port incident will perk up all concerned parties by improving and implementing safety regulations at the work premises.

Optimization of sesame seeds oil extraction operating conditions using the response surface design methodology

Haitham Osman, Abubakr Elkhaleefa and Ihab Shigidi

Response Surface Methodology (RSD) has been used to model experimental data obtained from extraction of sesame seeds oil using n-hexane, chloroform and acetone as solvents under different operating conditions .The developed model predicted that n-hexane with a rotational speed of 547 rpm and a contact time between the solvent and seeds of 19.46 hours with solvent: seeds ratio of 4.93, yields the optimum oil extracted of 37.03 %, outperforming chloroform and acetone models that gave prediction for 4.75 and 4.21 respectively.

Cadmium and Nickel Metal Ions Removal from Artificial Wastewater by Natural Clay Adsorption

Mohammad Ilyas Khan

The aim of this study was to investigate the adsorption characteristics of some natural clay materials from the Southern part of Saudi Arabia for the removal of cadmium and nickel metal ions from aqueous solutions. Atomic adsorption spectrometer (AAS) was used to estimate the residual metal ions concentration at the end of each adsorption experiment. In the first instance, the best type of clay adsorbent was evaluated and identified. Once, the best clay (in terms of removal efficiency) was identified, the effect of other factors such as pH, initial metal ions concentration, adsorbent dosage and contact time were studied. The optimum conditions for a 50 ml sample containing 40 ppm cadmium and nickel metal ions were identified as 1.2g clay with

2hrs of contact time and a neutral pH with a removal efficiencies of approximately 95%. The results show that this clay can be used as an efficient, cheap and environmental friendly adsorbent for the removal of heavy metals from waste water.

Electro Chemical Treatment for Textile Dye Effluent

Dhanaraja Dhanapal and Chandrakant S. Sarkar

Textile mills are one of the major industries generating huge quantity of waste water. It requires substantial volume of water and synthetic chemicals including dyes, but the fabrics do not absorb all the dyes because 50% of the dyes are hydrolysed which generates large quantity of effluents. These effluents contain untreated and hydrolysed dyes which form complex liquid effluents. In this context an attempt has been made to develop an electro chemical based treatment technique for this effluent. Depending on the nature of the effluents, Electro Oxidation Process was chosen. This treatment involves oxidation at the anode and reduction at the cathode. The effluents were treated by galvanostatic process at different flow rates varying from 10 lph to 50 lph at various current densities (2.5 A/dm2, 5.0 A/dm2, 7.5 A/dm2 and 10.0 A/dm2). COD were recorded for these flow rates and current densities. Encouraging results were observed at low lph (10 lph) and high current density of 10 A/dm2 where the COD recorded was the lowest.

Atmospheric Distillation of Waste Engine Oil

Abubakr Mustafa Elkhaleefa

Two types of used engine oil (A and B) have been characterized along with a fresh sample of each type, hence the properties changes and degradation were observed. The samples (A and B) subjected to Batch Atmospheric Distillation process. The distillated product was then analyzed. Results show that the product's specifications are similar to that of the gasoil, consequently developing valuable product from an industrial waste.

Civil Engineering Department

ANALYSIS OF SLOPE ALONG ABHA-DARB ROAD

Saiful Islam

The present study mainly deals with Analysis of Slope Along Abha-Darb Road, Asir Region, Kingdom of Saudi Arabia. For Analyzing Slope field study was carried out along the road cut slopes and soil was collected from critical zone where there is a probability of landslide. Laboratory experiments were conducted to determine the various physio-mechanical properties of soil mass. These properties have been used as input parameters for the numerical simulation of Slope (FLAC3D). The computed displacements and stress distribution are observed. Also FOS is calculated. The study indicates that the slope is unstable showing circular failure at the upper height along the slope, but is quite stable at the lower height. The effects of instability have been thoroughly considered.

Estimation of Potential Evapo-Transpiration of Asir Region, Kingdom of Saudi Arabia: Considering Climate Variability

Ram Karan Singh and Saiful Islam

Evapotranspiration is a major component of hydrological cycle. Its estimation is important for water resource management purposes and for understanding soil water balance at a place. It is known to be dependent upon climatic factors. In this study, the potential evapotranspiration of the Asir region located in southwestern part of Kingdom Of Saudi Arabia has been computed for three situations i.e. close ground crops, bare land and water surface considering it as a land use pattern of the Asir region other than built up areas. The result obtained will help the water resource management of the Asir region keeping in mind the climate variability factor. The data for various metrological factors, temperature, and wind speeds, relative humidity, sun shine hours and solar radiation for the period of (2003-2013) was collected from Metrological Department. Using the data, potential evapotranspiration was estimated using the internationally accepted PET version of Penman equation. The data was analyzed monthly. PET was found to show an increasing trend from January to June and decreasing trend from June to December having highest PET for the month June.

Fuzzy Mcdm Based Decision Support Model To Select Crop Pattern For Sustainable Agricultural Practices

Ram Karan Singh & M. N. Qureshi

The crop pattern has a significant impact on the feasibility of sustainable agricultural practices. Selected crop pattern influence environmental and economic condition and affect sustainability profoundly in agricultural practices. Hence, a careful intervention is required in the selection of an optimal crop pattern for sustainable agricultural practices. Selection of a particular set of crop pattern depends upon many criteria that may vary from place to place thus pose challenges in deciding an optimum crop pattern. The present research focuses on the crop selection pattern in Indian environment that considers comprehensive criteria related to sustainable farming practices. Based on the in-depth review of literature and experts opinion, comprehensive criteria related to sustainable farming practices for Ravi season crop are identified. Total twelve criteria covering socio-economic conditions, soil and water conditions, environmental and climatic conditions are earmarked and taken into account for eight most commonly grown crops in Ravi season and later on modeled to determine the crop pattern for most needed sustainability. A fuzzy based multi criteria decision making (MCDM) model has been developed considering the Indian farming system. The scarce resources availability to Indian farmers poses many challenges to practice farming with most needed sustainability. The present research will be useful in the area of Indian farming practices in particular and global farming practices in general. It will also help stakeholders in their cost effective decision making for better crop productivity leading to sustainable farming practices. Additionally, the state policy makers will be able to formulate effective state driven sustainable farming policy to enhance its stake in in gross domestic product (GDP) to become self-reliance.

Active Vibration Control of a tensegrity bridge

Mohamed Hechmi El Ouni, Nizar Bel Hadj Ali and Nabil Ben Kahla

This paper investigates the nonlinear modeling of a smart tensegrity pedestrian bridge with active damping using pairs of displacement actuator and force sensor, collocated at the end of cables. A control strategy based on decentralized collocated Integral Force Feedback (IFF) is employed. The response of the structure with and without active control is analysed in frequency and time domains . The results obtained indicate that the active control strategy presented in this paper is adequate for vibration attenuation of tensegrity bridges.

Evaluation of Seismic Performance of RC School Buildings in ABHA City, KSA

Mohammed Ahmed Ibrahim Ismaeil

School buildings have an important role in the educational process and they may serve as emergency shelters after earthquakes events. So, they need a complete strategy for evaluating their capability to face the probable earthquakes. In this study, the seismic risk of the reinforced concrete school building structure which is the most common types of school structures was evaluated by using the seismic performance evaluation methods. Therefore the evaluation of seismic performance of school buildings has received a great deal of attention of researchers in recent years. The large amount of damages that occurred in school buildings during earthquakes throughout the world has enhanced this attention. Most school buildings in Abha city are not designed and built to resist earthquakes. The objective of this project is to assess the seismic performance of school buildings in Abha city, KSA. Typical 5 story RC school frames, designed according to the Saudi Building Code (SBC301-2007), are investigated. An equivalent static analysis is carried out for this building using structural analysis software SAP2000. The RC shear walls and steel bracing methods are studied for strengthening RC school structures. These methods of strengthening will become the effective means in the retrofit of RC school buildings.

Electrical Engineering Department

Low-complexity Metaheuristic Techniques for Joint ML Estimation Problems

Thafasal Ijyas V. P. and Abdul Wase

Joint estimation of multiple parameters in a maximum likelihood (ML) framework has high relevance in contemporary engineering and scientific practice. The striking characteristic of these problems are their high computational load leading to impracticality in real-time implementations. Meta-heuristic algorithms offer a lot of latitude in exploiting the significant characteristics of specific estimation problems. Yet they have a heavy computational complexity. In this work, a novel initialization is proposed to meta-heurisitic algorithms that significantly reduce their computational complexity while improving performance in terms of mean square error and convergence. The method is applicable for joint maximum likelihood estimation problems, with cost functions that exhibit asymptotic separability with increase in observation vector size. The proposed method is adopted to five recently discovered heuristic algorithms and consequently applied to a relevant recent signal processing problem in wireless communication. It is found that the reformulated algorithms deliver both reduced computational complexity as well as better mean square error (MSE) performance. The significant features of the proposed method are substantiated through extensive computer simulation studies.

Wireless propagation channel modeling for optimized Handoff algorithms in wireless LANs:

Monji Zaidi

In this Work, we present a time-series analysis technique which covers the basic concepts and mechanisms driving the wireless propagation channel. We also use a generated series for simulation study of Handoff performance showing the impact of multipath phenomena. Moreover, the extraction of the average signal has been used to reduce significantly the number of unnecessary Handoffs. Until recently, Handoff mechanisms are implemented entirely in software, which increasingly becoming infeasible. Therefore, this work attempt to follow the top-down co-design approach providing hardware prototype which leads to reduce the power consumption and support high processing speed.

Frequency Offset Estimation and Cell Search Algorithms for OFDMA Based Mobile WiMAX

Fakher Eldin M. Suliman

Frequency offset estimation is an important issue in digital transceiver design, especially for coherent wireless transmission such as in WiMAX systems based on the IEEE 802.16e orthogonal frequency-division multiple access (OFDMA) due to inherited frequency and timing offset problems which contribute to the loss of the transmitted data. To overcome these problems, the transmitter and receiver must be well synchronized. In WiMAX systems, the downlink synchronization involves synchronization of carrier frequency and timing as well as identification of the preamble index. This paper introduces synchronization algorithms for frequency offset estimation and cell search. The performance of these algorithms was tested using simulation under adaptive white Gaussian noise and fading channel for different values of signal to noise ratio. Simulation results reflected that frequency offset in the received frame was successfully estimated.

Photovoltaic Generation Model for Power System Transient Stability Analysis

Abdelaziz Salah SAIDI

In this project, a PV generation model is established in DIgSILENT/PowerFactory. The model can reflect the non-linear output characteristics, fault ride-through response characteristics and output limits of photovoltaic generation. The transient response characteristics of PV model is simulated. The impact of large-scale grid-connected PV with or without LVRT capability on the power system transient stability is discussed based on the numerical simulation analysis using DigSilent Powerfactory software. The salient feature of this work is that, the transient stability analysis is carried out for IEEE-9 Bus Test system.

Mechanical Engineering Department

Investigations to Fix Process Parameters for Stir Casting

Vineet Tirth

Non-homogeneous distribution of dispersoids is one of the biggest problems being faced by researchers and industries developing particulate metal matrix composites (PMMCs) by vortex liquid metallurgy technique. Uniform particle distribution is extremely important in achieving homogeneous properties throughout the material otherwise recommendation for development of PMMCs by said technique is unreliable. Out of many fabrication techniques, liquid metallurgy route is one of the cheapest and simplest one. Moreover, this technique can be introduced in industries as such with minimum modifications in existing infrastructure and at very less cost provided; property variation of composites developed by this technique can be controlled. Lot of research has been carried out to determine optimum process variables to obtain fairly good PMMCs.
In this study, PMMCs were developed by dispersing Al_2O_3 in Al matrix using most simple experimental set-up in most raw working environment aiming development of PMMCs with uniform dispersoids distribution in the matrix, good retention of particles and prevention of clustering of dispersoids in the matrix at least cost. Various process parameters viz. stirring speed, stirring time, degree of superheat of melt, depth of immersed impeller and their optimum levels are discussed which play significant role in uniform dispersion and retention of dispersoids in matrix.

Impact of Stirrer Geometry on Retention of Ceramic Particles in Stir Cast Al-7%Al_2O_3 MMCs

Vineet Tirth

To optimize some of the parameters for uniform particle distribution for batch compocasting, the present study was conducted. This manuscript discusses various stirrer designs employed by the researchers wide over. In present study, some stirrers were fabricated and cast particulate metal matrix composites are prepared using them. The matrix is of commercially pure Aluminium and pretreated coarser alumina particles are dispersed using vortex liquid metallurgy route. Different stirrers are used in various experiments and other important factors which play role in incorporation and retention of dispersoids in the matrix are controlled to optimum limits as suggested by researchers in earlier studies. Microstructures of CPMMCs developed are analyzed and results are discussed. Different stirrer materials are also discussed. The casting conditions and environment of laboratory is kept very ordinary so that the set-up can be employed in industries with minimum infrastructure and cost.

Immersed Boundary Method-an Alternative Technique in CFD

Ahamed Saleel C

Handling of complex geometries with fluid-solid interaction has been one of the major issues in CFD because most engineering problems have complex geometries with fluid-solid interaction for a particular purpose. The immersed boundary method is an alternative technique suitable to simulate the flow with fluid-solid interactions compared with the conventional unstructured grid method. This poster details the immersed boundary method for the numerical investigation of pressure driven electro-osmotic flow and mixing in micro-channels constricted with triangular block. It is executed by introducing a momentum forcing function with a mass source/sink term as well as a concentration forcing function, which are respectively applied on the body surface and inside the body. The no-slip boundary condition is satisfied for the velocity on the immersed boundary satisfying the continuity for the cell containing the immersed boundary and no-flux boundary condition for species concentration on the immersed boundary. The method is based on a finite-volume approach on a staggered mesh together with a fractional-step method.

Processing Of Al_2O_3 / Polymer Composite with Studying Wear Property

M. Abdel-Aziz and Ali Algahtani

Composites can be defined as materials that consist of two or more chemically and physically different phases separated by a distinct interface. The different systems are combined judiciously to achieve a system with more useful structural or functional properties non attainable by any of the constituent alone. In this present work, the producing of Al_2O_3 phenolic resin red code 04-1030 composite with different additions (wt. %) was done using powder metallurgy method. A wear test used to study the behavior of wear of the investigated materials with different conditions ex: speed.

A microstructure examination was carried out an optical microscope for both base material and composite materials reinforced with Al_2O_3. Microstructure of composite has shown that a good distribution of Al_2O_3. Hardness measurement was done for the investigated materials. Study has shown that the increasing of Al_2O_3 additions the increasing of the hardness more than the matrix. The wear test carried out for the investigated materials and the results have shown that the increasing of Al_2O_3 additions the decreasing the wear rate of the composite materials than the matrix .The increasing of time wear the increasing the wear rate.

Solar Disinfection of Drinking Water with Polyethylene Terephthalate Bottles Coated with

Titanium Dioxide

Ibrahim EL-Sayed EL-Seesy

Water disinfection processes in the presence of titanium dioxide as a photo-catalyst material provide an interesting route to destroy contaminants, being operational in the UV-A domain with a potential use of solar radiation. In recent years, advanced oxidation processes (AOP) have been developed to meet the increasing need of an effective wastewater treatment. AOP generates powerful oxidizing agent hydroxyl radicals which completely destroy the pollutants in waste water. Solar disinfection of drinking water with polyethylene terephthalate (PET) bottles coated with photo-catalyst TiO2 has been shown to be very effective. The study is based on comparison between three systems for treating contaminated water samples using PET bottles. First system was a PET untreated bottle, the second system was a PET bottle coated with black paint on its outer surface. Finally the third system was a PET bottle coated also with a black coat on its outer surface and its inner part was treated with citric acid solution to enable np-TiO2 to cover the surface later on, then 0.2 g of np-TiO2 powder (of particle size <25 nm, Sigma-Aldrich) was added. The total bacterial accounts were determined to monitor the effect in the three systems. The experimental results have shown that disinfecting water with merely UV was less effective than combining the bottle with heat effect, and adding TiO2 film was further more benefited. This work can be applied in rural areas, with no technical support or need for expensive/dangerous chemicals for drinking safe water even if stored for two days.

Fabrication of Wood / Polymer Composite

M. Abdel-Aziz and Ali Algahtani

Composites, the wonder materials are becoming an essential part of today's materials due to the advantages such as low weight, corrosion resistance, high fatigue strength, and faster assembly. They are extensively used as materials in making aircraft structures, electronic packaging to medical equipment, and space vehicle to home building. Fe3O4 /polymer composite is a new material will be fabricated in this project. New property for the polymer will be added such as magnetic properties and wear resistance. The project can be used as a method for recycling of polymer.

In this present work, producing of wood/ polymer composite (thermoplastic polymer coded 04-1260) with different additions (20, 40 and 60%) was done using powder metallurgy method. A wear test used to study the behavior of wear of the investigated materials with different conditions ex: rotating speed. A microstructure examination carried out an optical microscope for both base material and composite materials reinforced with wood.

Microstructure of composite has shown that a good distribution of wood for wood /polymer composite with all additions used. Hardness measurement was done for the investigated materials. Study has shown that the increasing of wood additions lead to

increasing of the hardness more than the matrix and also more than wood only. The wear test carried out for the investigated materials and the results have shown that the increasing of wood additions the decreasing the wear rate of the composite materials than the matrix and wood only.

Concept of Carbon Neutral Airport

Vineet Tirth, Mustafa Al-Ani, Mohannnad Alqhtani and Saad AL-Mashhour.

In the Kingdom of Saudi Arabia (KSA), aviation is a major means of mass transport. The growth in aviation and airport activities has raised serious doubts about sustainability with environment and climate change perspective. Air quality deterioration due to increased GHG emissions is one major consequence. Airports have lots of free space due to restrictions on human activities are the service hubs for dealing with the aircrafts. Thus, an airport provides space and opportunity to be used for neutralizing the carbon emissions due to the movement of the aircrafts. The reduction of carbon emissions is a three-step process which includes estimation of carbon emissions (or carbon foot print-CFP), reduction in carbon emissions and offsetting the carbon footprints.
In present work, the sources of carbon emissions at Abha international airport, Kingdom of Saudi Arabia are discussed and methods to neutralize it have been suggested to reduce its carbon footprint by including 360O approach and techno-socio-economically feasible measures.

Improving Film Cooling From Compound Angle Holes By Adding Secondary Holes Branched Out From The Main Holes

Mostafa A. H. Abdelmohimen

A numerical simulation is used to investigate the effect of adding secondary hole branched out from a compound angle injection hole. The use of secondary holes with compound angle film cooling is considered as a novel concept of compound angle film cooling. The used orientation angle is 30°. The diameter of the secondary hole is half of the main diameter (compound angle injection hole diameter). The studied cases are considered at blowing ratios of 0.5, 0.75, 1.0, 1.5, 2.0, and 2.5. The study was carried out using the realizable k-ε model. The presence of the secondary hole improves the film cooling at all studied blowing ratios except at M = 0.5 due to the weakness of the coolant flow through the main hole. The flow through the secondary hole tries to damp the vortex coming out from the main hole. The optimum blowing ratio is at M = 0.75–1.0. The enhancement in the overall film cooling effectiveness at M = 1 is 0.12 as compared to the compound angle injection hole case by about 83%.

Mathematical modelling of a H_2 dual fueled diesel engine vibrations

Javed Syed, Shaik Abdul Siddique, Afroz Ahmed Khan Saudagar, Mohammed Shafiuddin

The quest for clean and renewable energy source is the paradigm of the researchers. Hydrogen (H_2) fuel is a strong candidate for energy substitution in a dual fuel diesel engine producing lower greenhouse emissions. However, the suitability of H_2 fuel in the prospect of vibrations generated from a dual fuel diesel engine need to be the inquest. An experiment was conducted, and a mathematical model is proposed to predict the vibrations. The benchmark metrics indicates that the proposed mathematical model predicts vibrations scrupulously.

Investigations on Hydrodynamic Journal Bearings

E. Abhilash and Mohammed Shabbir

New design principles and practices have compelled the professional engineers and scientists to study the phenomena of friction, lubrication and wear in a systematic and integrated manner, with a view to controlling and using them for design, manufacture and exploitation of newer and better properties and increasing the service life of marketable products like bearings. If the bearing surface and shaft is fully separated by the fluid lubricant and there is no contact between solid components, the bearings are called fluid film bearings. The fluid film bearings which operates on hydrodynamic lubrication is also called 'self-acting' in which the load is supported due to the wedging effect of the lubricant caused by the relative tangential motion between the journal or shaft and the bearing. Hydrodynamic journal bearings are commonly used in various rotating machines such as pumps, compressors, fans, turbines and generators are widely used in industries. Design of hydrodynamic bearing involves finding a suitable combination of bearing diameter and/or length that will operate with a suitable viscosity and reasonable clearance. Equations and theories used for the determination of load carrying capacity, minimum oil film thickness, friction loss, and temperature distribution are very important aspects in the design of hydrodynamic journal bearings. This study makes a comprehensive study on bearings and its applications besides understanding the applications and properties of bearing lubricants. Other objectives are to understand the influence of rotational speed, bearing load, temperature on frictional force in a hydrodynamic journal bearing system for a sample engine oil (ISO 32 grade), to determine coefficient of friction at various bearing loads and to theoretically analyze the experimental observations.
From the experiments it is observed that the temperature increases with frictional load. However, the influence of the temperature must be seen in conjunction with the lubricant, since the viscosity is a major depending parameter. A major influence on the frictional load is exerted by the rotational speed compared to the bearing load. Coefficient friction is inversely proportional to load and directly proportional to speed and viscosity of lubricant. For the coefficient of friction, the influence of load is found to have a greater influence than that of rotational speed. Also, theoretical analysis was performed to analyze the experimental observations on coefficient of friction. Polar diagram of film-pressure distribution within the bearing was also constructed using Raimondi and Boyd charts for bearing design.

Optimum Linear Quadratic Regulator Control for Clutch Thermal Energy

Amir Ibrahim Ali Arabi

Recently, the engagement control of automotive dry clutches is becoming more and more important, due to the increasing use of Automated Manual Transmissions (AMT). Control strategies aim to improve the clutch dynamic response during the engagement phase. The main objectives of this research are reducing the transient time during clutch slipping phase and the friction energy dissipation that are generated during the clutch engagement process during starting up phase. The design approach of the control strategy is based on the optimal control method, which is Linear Quadratic Regulator (LQR). The aim of the control strategy is to find the optimal tracking of the rate of change for clutch clamping force. This can be established by determining an optimal feedback gain matrix that achieves some compromises between the use of control effort and clutch system response. Simulation model has been built to simulate the strategy. The LQR achieves reduction by 18.0 % of friction losses and shortens the slipping time by 18.9 % as compared with open loop strategy for throttle opening (10%). Different starting up conditions are investigated.

Industrial Engineering Department

Optimization of Energy Consumption in Wastewater Treatment Plants

Mohammed Mousa Alqahtani

In this research, we investigate the energy consumption in a wastewater treatment plant (WWTP) and propose optimization models for optimal operations of WWTP, to move towards a sustainable and green WWTP. We start to investigate the energy consumption by categories, where we found that the aeration and pumping processes consume the largest portion of energy compared to all other processes (or categories). After that, we find the associated objective functions that illustrate the energy consumption in each process. Finally, we construct the optimization model to minimize the operating cost of WWTP (including energy cost), and use the nonlinear programming approach to find the optimal solution. In the aeration process, we conduct the optimization by finding the optimal values of the air flowrate. This variable related to the energy consumption of submerged diffusers in the aeration tank. As for the pumping process, we use neural network algorithm to minimize pumping energy consumption by scheduling the operations of the pumps throughout the day.