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Fatigue Analysis of the Weldments of the Suspension-System-Support for an Off-Road Vehicle under the Dynamic Loads Due to the Road Profiles

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In this study, a numerical method has been developed to estimate the fatigue life of the vehicle chassis-components. The application of this method will significantly reduce the expenses for the required practical or in-service tests. In this method, firstly, using MATLAB, the real but random profiles for the standard roads have been produced on the basis of the random vibration theories, which give the spatial profile data in terms of time. These profiles have been used to study the dynamic behavior and to design the vehicle chassis. Then, a complete off-road-vehicle model has been developed and first-stage results have been used as input data to simulate the dynamic behavior of the model and to calculate the forces and displacements of the chassis structure using MSC.ADAMS. In this way, the optimum stiffness of the suspension system has been obtained. Finally, using the FEM based software; ANSYS, the stress distribution in a selected part-weldment (support of the front suspension system) has been obtained and fatigue life of the structure-components welds; joining the suspension system to the off-road vehicle chassis, has been calculated and the effects of the dynamic loads due to the road profiles have been studied. (*Asian Journal of Applied Sciences 2 (1): 1-21, 2009; doi: 10.3923/ajaps.2009.1.21*)

The Effect of Connection-Plate Thickness on Stress of Truck Chassis with Riveted and Welded Joints under Dynamic Loads

M. Zehsaz, F. Vakili Tahami and F. Esmaeili

In this study the mechanical behaviour of a semi-heavy truck chassis has been studied using finite element based Ansys Code and the stress distributions in the chassis have been obtained and examined. For this purpose, the FE model of the truck vehicle has been created using 3D shell elements. To validate the FE model of the chassis; firstly, experimental modal analysis has been used. Secondly, the modes of chassis-vibration, natural frequencies and modal shapes have been obtained from the FE analysis and were compared with the results of experimental modal analysis. The dynamic forces due to the unevenness of the road have been calculated using a simple 3D dynamic model of the truck body. Then, stress analysis for the truck chassis have been carried out under static and dynamic

loads. Different types of joints and their thickness in the chassis of truck vehicles are one of the important parameters which have significant effect on their strength. To study the effect of the connecting plates on the strength of the chassis, the strength of the welded and also the combined welded-riveted joints has been analyzed with three different plate thicknesses: 5, 8, 12 mm. The results show that the amount of stresses in chassis and connection plates are decreased significantly with increasing the thickness of connection plates. Also, it has been shown that the use of combined welded-riveted joints reduces the stress level of the chassis. The results prove the precision of the FE modeling and they show that the numerical modeling is accurate and therefore, the stresses which have been obtained are reliable and can be used to design the chassis. (*Asian Journal of Applied Sciences* 2 (1): 22-35, 2009; doi: 10.3923/ajaps.2009.22.35)

Comparing Classical and Modern Signal Processing Techniques in Evaluating Modal Frequencies of Masjed Soleiman Embankment Dam during Earthquakes

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In this study, the classical and modern signal processing methods are used to extract dominant frequencies of Masjed Soleiman dam, the highest embankment dam in Iran. The signals were recorded in the gallery, mid-height and the crest of the dam during local earthquakes. Since the amplitude and frequency contents of earthquake acceleration time histories vary with time, classical signal processing techniques are limited to extracting the exact characteristics of the signal. Time-frequency distribution and wavelet analysis were used in this study to overcome this limitation. The proposed modal frequencies of the dam body were evaluated using both the classical and new techniques and the results compared. Differences between the two sets of methods are described and the benefits of the modern signal processing methods are discussed. It is shown that, in non-stationary signals such as earthquake records, higher frequencies are extracted by modern methods that cannot be obtained using classical methods. Besides, the spectral variations of the scalograms clearly indicate that lower frequency contents become more dominant as the excitation amplitude decreases. The lower mode shapes of dam body are excited during the weak part of an earthquake, whereas during the stronger part, all the high and low modes are excited. (*Asian Journal of Applied Sciences* 2 (1): 36-49, 2009; doi: 10.3923/ajaps.2009.36.49)

Comparing Numerical Analysis Predictions and Experimental Data for Shirindarreh Embankment Earth Dam

E. Aflaki

This study deals with the analysis and monitoring aspects of Shirindarreh earth dam with the height of 64 m which is located in the northern Khorasan Province in Iran. Characteristics of the foundation and six types of available materials for construction are described. For design of this dam, the major considerations were controlled under seepage and deformations i.e., arching and settlement criterion. Large deformation of the body and foundation of an earth dam can cause the core to be cracked. As a result, concentrated seepage and piping through the core might be developed. On the other hand, control of the stresses in the core and shell needs specific attention to the arching phenomena. To achieve the above mentioned purposes data from monitoring of instrumentations have been compiled. Stress-strain distribution in the body and foundation of the Shirindarreh earth dam at the end of construction is evaluated using PLAXIS software (Version 7.2) and its hardening soil model which is based on total stress approach. The results have been compared with measured data. Generally, the results of back analyses show good agreement with those of instrumentation. (*Asian Journal of Applied Sciences* 2 (1): 50-62, 2009; doi: 10.3923/ajaps.2009.50.62)

Superconducting Properties of $(\text{Tl}_{1.6}\text{Pb}_{0.4})\text{-2223}$ Substituted by Praseodymium

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The lattice parameters, electrical resistivity, ac magnetic susceptibility, magnetoresistance and Hall effect have been measured for a newly developed compound obtained through partial substitution of Ca^{2+} ions by Pr^{3+} ones in $(\text{Tl}_{1.6}\text{Pb}_{0.4})\text{Ba}_2\text{Ca}_2\text{Cu}_3\text{O}_{10-\delta}$. For such compound, the prepared samples are almost single phase of (Tl, Pb)-2223 tetragonal unit cell with a space group $14/mmm$. An opposite behavior for both lattice parameters a and c was observed as the concentration of Pr-content was increased. Also, metallic tendency was observed from electrical resistivity measurements in the range of $0 \leq x \leq 0.15$ for temperature values above the superconducting transition temperature T_c . On the other hand, a semiconductor-like behavior was noticed for values $x > 0.15$. Suppression in the superconducting transition temperature was found as the Pr-content was increased. This suppression in superconductivity for the system evolved was discussed according to two models point of views; the Cooper-pair

breaking and hole-filling models. The transverse magnetoresistance, below the superconducting transition temperature, was measured in a weak magnetic field up to 4.8 kg. Finally, the Hall voltage was measured at different temperature values above that of superconducting transition using five-probe technique. The Hall coefficient, Hall mobility and Hall angle were expressed as functions of both temperature and Pr-content. (*Asian Journal of Applied Sciences* 2 (1): 63-73, 2009; *doi*: 10.3923/ajaps.2009.63.73)

Deposition of Oxide Layer on Aluminium Via Plasma Electrolysis Method in Alkali Solutions by Unipolar Pulsed Current System and Study of its Physical Properties

N. Parvini Ahmadi, R.A. Khosroshahi and B. Baghal Asl

The principle aim of the present study is to produce Plasma Electrolytic Oxidation (PEO) coating on aluminum via unipolar pulsed current system and to indicate that it is possible to attain the similar bipolar system results reported in the literature. A brief comparison was also made between unipolar deposit properties with those achieved via direct current (duty cycle 100%) system. In the present study, a hard ceramic layer was produced on aluminum by PEO method under unipolar pulsed current system. The results showed that unipolar pulsed current system considerably improves oxide layer properties due to its better deposit growth control as compared with direct current system. The mean hardness value of the PEO coating was found to be 1700 Vickers. (*Asian Journal of Applied Sciences* 2 (1): 74-82, 2009; *doi*: 10.3923/ajaps.2009.74.82)

Electroless Ni-P Deposition on WE43 Magnesium Alloy Substrate

R. Azari Khosroshahi and N. Parvini Ahmadi

With the aim of study the nucleation and growth mechanism electroless Ni-P plating was applied to electrochemically heterogeneous WE43 magnesium alloy substrate. Experimental results revealed that the coating was preferentially nucleated on equilibrium β phase at along some grain boundaries and matrix dislocations. These were then spread to primary α phase. X-ray diffraction analysis of as deposited coatings showed a broad peak in the spectra, indicating an amorphous structure possibly with small microcrystalline areas. These were transformed to crystalline phase after annealing at temperatures 250 and 400°C for 1 h. Micro hardness testing results showed an increase in hardness from mean

values of 650 Vickers for as plated samples to 960 and 1030 Vickers for the coated samples after annealing at 250 and 400°C for 1 h, respectively. (*Asian Journal of Applied Sciences* 2 (1): 83-90, 2009; doi: 10.3923/ajaps.2009.83.90)

Simulation of Paris-Erdogan Crack Propagation Model with Power Value, $M = 3$: The Impact of Applying Discrete Values of Stress Range on the Behaviour of Damage and Lifetime of Structure

A.A. Shariff

The aim of this study is to investigate the impact of applying stress sequence in the form of discrete values of ascending and descending order of the same range on the behaviour of damage. The behaviour of the crack propagation as well as the lifetime of structure is investigated when M , which is the power value in the crack propagation Paris-Erdogan model is taken to be equal to three ($M = 3$). It is found that bigger stress or loadings imposed on the structure at the beginning of its life will result in a bigger damage. As a result, the lifetime of the structures is shorter as compared to the one which starts with lower stress. (*Asian Journal of Applied Sciences* 2 (1): 91-95, 2009; doi: 10.3923/ajaps.2009.91.95)

Molecular Interaction Studies on Some Organic Liquid Mixtures at Different Temperatures Using Ultrasonic Technique

P. Vasantharani, P. Kalaimagal and A.N. Kannappan

The ultrasonic velocity, density and viscosity in ternary liquid mixtures of tri-n-butyl amine (TBA), n-hexane with aliphatic alcohols viz., 1-pentanol and 1-hexanol have been measured at three different temperatures 303, 308 and 313 K for the entire range of concentration using an ultrasonic interferometer. The measured data are used to compute the acoustical properties, namely adiabatic compressibility (β), free length (L_f), free volume (V_f) and internal pressure (π_i) and their excess values. The intermolecular attraction between the components dependence on the mutual association of similar molecules and there disassociation due to attraction between dissimilar molecules. The strength of the bond dependence on the length of the alkyl chain and the branching in the alkyl group. (*Asian Journal of Applied Sciences* 2 (1): 96-100, 2009; doi: 10.3923/ajaps.2009.96.100)

Preliminary Investigation of a Converted Four-Stroke Diesel to Alpha V-Shaped Stirling Engine

I.M. Yusof, N.A. Farid, Z.A. Zainal, G.B. Horizon and M. Azman

This study presents a preliminary investigation on a converted four-stroke diesel to an air charged V-shaped Alpha Stirling engine. The engine was manufactured with a total swept volume of 194 cc., volume compression ratio of 1.84, 90° phase angle and air as a working gas. The engine was designed to fulfill the requirements of hot end temperature up to 1000°C, cold end temperature of 20 to 30°C, charge pressure of minimum 1 bar or above and engine speed up to 1200 rpm. Design considerations of developing a simple and low cost Alpha-typed Stirling engine using major components of both commercial diesel engine and industrial mass production were discussed. Major modifications were done on the engine heater head design in order to cater for both natural gases and biomass fueled heating process as the external heat source. The net power output was estimated about 25 W at minimum charge pressure of 1 bar using Beale formula. The preliminary results show that the friction torque increases with the increase of engine speed. The minimum friction torque of 0.80 Nm was obtained at minimum speed of 300 rpm and the maximum friction torque obtained was approximately 1.30 Nm at the speed of 1200 rpm. The gas pressure inside the working cylinder also increases with the increase of engine speed and the maximum mean pressure obtained with the effect of engine speed and hot temperature was approximately 1.41 bar. (*Asian Journal of Applied Sciences* 2 (2): 101-114, 2009; *doi*: 10.3923/ajaps.2009.101.114)

Investigating Synergism in Critical Micelle Concentration of Anionic-Nonionic Surfactant Mixtures: Surface Versus Interfacial Tension Techniques

Mazen Ahmed Muherei and Radzuan Junin

In this research, anionic (SDS) and nonionic (TX100) surfactant mixtures (1:2, 1:1, 2:1; TX100: SDS mass ratios) were evaluated for possible synergism in Critical Micelle Concentration (CMC). Synergism of both surfactants was sought in presence of shale and/or oil phase. The composition of mixed micelles and the interaction parameter, β evaluated from the CMC data obtained by both Surface Tension (ST) and Interfacial Tension (IFT) for different systems using Rubingh's theory were discussed. Both techniques give comparable conclusions regarding synergism in CMC. However, using IFTs to determine CMCs before and after

equilibration with shale showed greater losses of nonionic surfactant than using ST technique. For the interfacial tension data, β -values ranges from -5.803 to -5.917 before equilibration with shale and from -1.286 to -2.045 after equilibration with shale for the mixtures with TX100 mole fractions of 0.18 and 0.47, respectively. This result suggested that synergism was always stronger before equilibration with shale and/or contact with oil phase. Among the mixtures studied, the mixture with higher TX100 mole ratio exhibit more synergism than others. This is particularly true after equilibration with shale and/or contact with oil phase pointing out to the role, the losses of TX100 may have on synergism of TX100-SDS mixtures. (*Asian Journal of Applied Sciences* 2 (2): 115-127, 2009; **doi:** 10.3923/ajaps.2009.115.127)

Material and Magnetization Effect on Permanent Magnet Motor Design

M.A. Tavakkoli and S.M. Madani

Permanent Magnet (PM) motor materials affect on their developed torque, torque pulsation and other performances. However, the performance sensitivity to the material changes by material and motor types (SFPM, Inset, IPM, Buried ...). Usually, PM motor designers optimize the motor based on motor dimensions and topology and less on material selection. However, material has significant effect on motor performances. Choosing high quality and expensive material does not always guarantee to improve torque quality and quantity. This study analyzes the performance sensitivity versus material magnetic characteristics for SFPM and IPM motors. Moreover, the optimum material based on developed average torque is presented. Then, we analyze PM magnetization effect on air gap magnetic flux density. (*Asian Journal of Applied Sciences* 2 (2): 128-138, 2009; **doi:** 10.3923/ajaps.2009.128.138)

Comparative Study of Different Hierarchical Bases of Finite Element Method: Application to Elastostatic Analysis of Two-Dimensional Structures

M.K. Sangare, E. Danho, R.N. Djue and K.E. Kanga

This study briefly presents three types of well known and widely used hierarchical p -element shape functions: the noninterference condition formulation, the Lagrange formulation and the Legendre formulation for both quadrilateral and triangular elements. A comparative study of these three formulations is made through a set

of linear elastic two-dimensional numerical applications. The meshes used are essentially made of 9 node quadrilateral and 7 node triangular elements for initial comparisons. The results of these comparisons indicate that even if the Legendre type formulation exhibits the better condition number of stiffness matrix, it is not the best p -element formulation in case of distorted meshes or for convergence stability of computed values of stress. (*Asian Journal of Applied Sciences* 2 (2): 139-149, 2009; **doi**: 10.3923/ajaps.2009.139.149)

Cluster Analysis of Rainfall-Runoff Training Patterns to Flow Modeling Using Hybrid RBF Networks

H. Abghari, M. Mahdavi, A. Fakherifard and A. Salajegheh

The artificial intelligence modeling of nonstationary rainfall-runoff has some restriction in accuracy of simulation base on complexity and nonlinearity of training patterns. Statistical preprocessing of trainings could determine homogeneity of rainfall-runoff patterns before modeling in artificial intelligence. In this study, the new hybrid model of artificial intelligence in conjunction with statistical clustering is introduced. Statistical pre-processing effects of 360 rainfall-runoff patterns considered before modeling using Radial Basis Function Neural Networks (RBFNNs). In the first step all 360 monthly rainfall-runoff patterns classify by cluster analysis in 4 groups and each class modeled by different RBFNNs topology. Results of 4 cluster base-RBFNNs compare with no action one and the optimized structure of Hybrid Cluster base-RBFNN models of Nazloochaei river flow present. Results show that clustering of rainfall-runoff patterns and modeling of each dataset by different RBFNNs has higher accuracy than no preprocessing of patterns in prediction and modeling of river flow. (*Asian Journal of Applied Sciences* 2 (2): 150-159, 2009; **doi**: 10.3923/ajaps.2009.150.159)

Social Representation of Students from Two Engineering Schools According to Their Future Professional Activities

L.K. Houssou

This study examines the social representation of students from two engineering schools at the Institut National Polytechnique Félix Houphouët Boigny (INP-HB) according to their future occupations. It contributes to the general literature of social representation by focusing on the quantitative method of paired comparison. The investigation was carried out by establishing a scale of preference for nine statements expressing various professional activities performed by engineers. A group of students from two engineering schools (College of Industry (ESI) and

College of Commerce and Business Management (ESCAE)) participated in this research. Results have shown that the application of the method of paired comparisons in the hypothesis of three by Thustone makes the discriminative variance process remains constant whatever the pairs considered. The calculation of scores is made from the conversion of frequency into standard deviation. This conversion has allowed us to obtain the matrix of standard deviation for each school. The average of standard deviation for each item column is calculated to obtain the average score for the items considered. According to the items selected, students have divergent choices depending on their membership to a particular school. Thus, knowledge produced by the analysis of representation is not only a mere analysis of speech or interpersonal exchanges, but it constitutes an invaluable means for the understanding of the basic system of thought and personal or collective actions of the students. (*Asian Journal of Applied Sciences* 2 (2): 160-168, 2009; doi: 10.3923/ajaps.2009.160.168)

Ultrasonic Velocity, Viscosity, Density and Excess Properties of Ternary Mixture of N-Methylcyclohexylamine+ Benzene+1-Propanol

P. Vasantharani, V. Pandiyan and A.N. Kannappan

Ultrasonic velocity (U), viscosity (η), density (ρ) has been measured for ternary mixture of N-methylcyclohexylamine with 1-propanol using benzene as a solvent at three temperatures 303.15, 308.15 and 313.15 K, over the entire range of composition. Adiabatic compressibility (β), free length (L_f), free volume (V_f) and internal pressure (π_i) have been calculated using experimental values of ultrasonic velocity (U), viscosity (η) and density (ρ). The results have been used to discuss the nature and strength of intermolecular interactions in the system. Excess values of the above said parameters were plotted against the mole fraction of N-methylcyclohexylamine over the entire composition range, indicates that the strong and weak hydrogen bonding interaction between the molecules of the mixture. (*Asian Journal of Applied Sciences* 2 (2): 169-176, 2009; doi: 10.3923/ajaps.2009.169.176)

Nematic Calamitic Bisazobenzene Liquid Crystal: Synthesis and Mesomorphic Properties of 1-Methoxybutyloxy-4'-(4-Phenylazo) Azobenzene

M.Z.A. Rahman, A.A. Salisu, S. Silong, M.R. Lutfor and M.B.A. Ayub

A new calamitic liquid crystal material with rod-shape bisazobenzene moieties as a core has been synthesized and characterized by spectroscopic methods. The

mesomorphic properties were investigated by differential scanning calorimetry and polarizing optical microscopy. The rod-shaped molecule 1-methoxybutyloxy-4'-(4-phenylazo)azobenzene was prepared by diazotization of 4-phenylazoaniline, coupling with phenol and subsequent etherification of 1-Bromobutyloxy-4'-(4-phenylazo) azobenzene in methanol. The presence of nematic mesophase was confirmed by the textures. (*Asian Journal of Applied Sciences* 2 (2): 177-183, 2009; **doi**: 10.3923/ajaps.2009.177.183)

Flow Injection Analysis System for the Determination of Total Phenolic Compounds by Using Folin-Ciocalteu Assay

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A simple, rapid and reliable flow injection analysis system for the determination of total phenolic compounds using the Folin-Ciocalteu method was established. The detection method was based on the reduction of a mixture of phosphotungstic and phosphomolybdic acid (Folin-Ciocalteu reagent) to tungsten and molybdenum oxide by phenolic compounds in the basic media and subsequent formation of a blue color product. The standard or sample solutions were injected into a carrier stream (distilled water) to react with a folin ciocalteu reagent and sodium carbonate to give the blue color product which was detected by spectrophotometer at 765 nm. The experimental conditions such as sample volume, flow rate of carrier and reagents, length of reaction coils and concentration of reagents were optimized. The relative standard derivation, RSD (20 replicates) of 5 ppm gallic acid was 0.72% with the detection limit (3S/N) of 0.0231 mg L⁻¹. A good linear calibration curve in the range of 0.5-100.0 mg L⁻¹ was obtained with regression equation $y = 0.0123x + 0.021$, $R^2 = 0.9991$. The sampling throughput was 32 samples per hour. The effect of potential interferences such as citric acid, fructose and others were examined. The proposed method was successfully applied for the determination of the total phenolic compounds in tea. (*Asian Journal of Applied Sciences* 2 (2): 184-190, 2009; **doi**: 10.3923/ajaps.2009.184.190)

Study of Structure, Surface Morphology and Optical Property on ZnO: Al Thin Films as Anti-Reflecting Coating

H. Abdullah, R. Silvia and J. Syarif

The significant influences of substituting low concentration Al at Zn-site as an anti-reflecting coating (ARC) for Zn_{1-x}Al_xO compound on structure; morphology

and optical property have been studied. The $Zn_{1-x}Al_xO$ sample with $x = 0, 5, 10$ and 15 wt.% were synthesized via a sol gel method. The films obtained from the sol gel method have been annealed at 400°C for 2 h. The XRD, SEM and AFM have been applied for characterizing the structure and the morphology of the film. XRD spectra show all samples exhibit hexagonal structure. The morphological measurements show that particle size decreases with increasing the concentration of Al. These films exhibit a denser and compact film's structure that could be effective in light trapping in thin film solar cells. The optical property has been characterized using UV-Visible-NIR spectrometer. The values of band gaps increase as the concentration of Al increases. The increase of the band gap is acceptable as a requirement for good anti-reflecting coating element. Therefore these films can be applied as anti reflecting coating thin film solar cells. (*Asian Journal of Applied Sciences* 2 (2): 191-196, 2009; doi: 10.3923/ajaps.2009.191.196)

Comparison of Static and Dynamic Backcalculation of Flexible Pavement Layers Moduli, Using Four Software Programs

M. Ameri, N. Yavari and T. Scullion

Backcalculating layer moduli, using the deflections measured by the FWD (Falling Weight Deflectometer) device, is the basis for structurally evaluating pavements when considering maintenance and rehabilitation options. Many algorithms have been developed to perform the backcalculation. Most of them are based on simplified assumptions such as the elastic behavior of the pavement and static load. These algorithms use the peak values of loads and deflections recorded by the FWD sensors. The dynamic analysis, to the contrary, accounts for the dynamic nature of the load and factors such as material inertia and damping. These algorithms use as inputs both load and deflection time histories measured by the FWD. In this research, three software programs, MODULUS 6.0, ELMOD 5.0 and EVERCALC 5.0, were used to do the elasto-static back-analysis and the DBSID program was employed for the dynamic backcalculation. The FWD data gathered from different test sites, including the Zanjan-Tabriz, Eivanekey-Garmsar and Garmsar-Semnan freeways and also Rafsanjan airport have been used in this evaluation. The results have been compared, the performance of each program has been evaluated and the best software for the sites under study is suggested. (*Asian Journal of Applied Sciences* 2 (3): 197-210, 2009; doi: 10.3923/ajaps.2009.197.210)

Seismic Design of FRP Reinforced Concrete Structures

M. Kazem Sharbatdar and Murat Saatcioglu

Experimental research has been conducted at the Structures Laboratory of the University of Ottawa to investigate the seismic performance of FRP reinforced concrete structural elements. Large scale columns and beams are being tested under simulated seismic loading. Fiber Reinforced Polymer (FRP) reinforcement is being developed in the form of longitudinal bars and transverse grids for use in new concrete elements in bridges and buildings. Since, this kind of reinforcement shows linear stress-strain characteristics up to failure and has low ductility, serious concerns should be considered about their applicability to earthquake resistant structures. The results of selected tests are summarized in this study, with the assessment of their significance from seismic performance perspective. Column and beam specimens were tested under lateral deformation reversals. The members were reinforced with carbon FRP bars in the longitudinal direction and carbon FRP grids in the transverse direction. Both the columns and the beams sustained a minimum of 2-3% lateral drift ratios, meeting seismic drift limitations of most building codes. Test results indicate that FRP reinforced concrete elements exhibit reduced stiffness and softened response because of the lower elastic modulus of FRP bars. This may suggest reduced spectral values associated with longer vibration periods, as well as increased deformability, resulting in seismic resistant structures for which elastic design approach with sufficient deformability may be appropriate. (*Asian Journal of Applied Sciences 2 (3): 211-222, 2009; doi: 10.3923/ajaps.2009.211.222*)

Engineered Cementitious Composites for Repair of Initially Cracked Concrete Beams

A.M. Anwar, K. Hattori, H. Ogata, M. Ashraf and Mandula

The current research addresses Engineered Cementitious Composites (ECC) as a new alternative for retrofitting damaged concrete beams. Twenty-one plain concrete beams with pre-defined artificial cracks were prepared and repaired using different combinations of ECC alone or together with Carbon Fiber Reinforced Polymers (CFRP). The study showed that replacement of the inferior layer from the bottom of the deteriorated beams with a thin layer of ECC could be able to restore the beam to a condition better than its original state. Moreover, the repair with ECC was found effective in enhancing the member ductility as well. It was also shown that pasting CFRP directly over ECC substrate resulted in shear

failure rather than the undesirable interfacial debonding mode of failure that typically occurs in case of concrete substrates. (*Asian Journal of Applied Sciences* 2 (3): 223-231, 2009; doi: 10.3923/ajaps.2009.223.231)

Three-Dimensional Numerical Modelling Study of Sound Speed in the Persian Gulf

M. Sadrinasab and K. Kenarkohi

The three-dimensional variability of sound speed in the Persian Gulf is investigated. In this study, a three-dimensional hydrodynamic model (COHERENS) is employed in a fully prognostic mode to derive sound speed profiles in the Persian Gulf, an evaporation-driven inverse estuary that is governed by the import of surface water from the adjacent ocean and the export of saline bottom gulf water through the Strait of Hormuz. During spring and summer, a cyclonic overturning circulation establishes along the full length of the Gulf. During autumn and winter, this circulation breaks up into mesoscale eddies, laterally stirring most of the Gulf's surface waters. Results of the model show that sound speed in the Persian Gulf depends mainly on the temperature in the surface layer whereas the bottom layer as well as the southern part of the Gulf depends on temperature and salinity. Maximum sound speed occurs during the summer in the Persian Gulf which decreases gradually moving from the Strait of Hormuz to the north western part of the Gulf. A gradual decrease in sound speed profiles with depth was commonly observed in almost all parts of the Gulf. However, an exception occurred in the Strait of Hormuz during the winter. The results of the model are in very good agreement with earlier observations. (*Asian Journal of Applied Sciences* 2 (3): 232-239, 2009; doi: 10.3923/ajaps.2009.232.239)

Analytical Solution for Free Vibrations of a Mass Grounded by Linear and Nonlinear Springs in Series Using He's Parameter-Expanding Methods

A. Kimiaefar, A.R. Sohoul, M. Rahimpour, M. Vaezi and D. Ganji

In this study, a powerful analytical method, called He's Parameter-Expanding Method (PEM) is used to obtain the exact solutions of nonlinear free vibrations of a mass grounded by linear and nonlinear springs. Based on a single equation of motion in terms of relative displacement variable, a qualitative analysis is completed and some interesting dynamic behaviors are discovered. The ranges of

oscillations are determined and expressions of exact periods for symmetric and asymmetric oscillations are established. It is shown that one term in series expansions is sufficient to obtain a highly accurate solution, which is valid for the whole solution domain. Moreover, the numerical solution based on shooting method and fourth order Runge Kutta method have been developed. Comparison of the obtained solution with those obtained using numerical method shows that this method is effective and convenient for solving this problem. This method introduces a capable tool for solving this kind of nonlinear problems. (*Asian Journal of Applied Sciences* 2 (3): 240-247, 2009; doi: 10.3923/ajaps.2009.240.247)

The Effect of Heat on Radio Iodine in Water in Sistan and Bloucheestan Province of Iran

S.A. Hosseini, A.A. Rakhsh Khorshid and M.E. Qureshi

The study was conducted for the investigation of heat effect on radioactivity in the drinking water of chah-nimeh Station of Zaboul and Khatam hospital well for irrigating gardens of Zahedan in Iran. This drinking water supply has provided drinking water of Zahedan. The technique of Gamma Ray Counting was applied using I-125 detector. Activity concentration levels due to I^{125} was measured in 50 mL water samples collected at a volume of about 500 mL at the depth level of 0-25 cm with a step of 5 cm depth. It is resulted that activity concentration range of the concerned radio nuclides in case samples of Zaboul for 20, 30 and 40°C temperature of the drinking water were as follows: 6.08 ± 0.08 , 15 ± 0.17 and 6.6 ± 0.8 Bq L⁻¹, respectively and control samples 5.6 ± 0.08 Bq L⁻¹ for any temperature. Radioactivity concentration from Khatam hospital well water case samples were 12 ± 2 , 14 ± 2 and 13 ± 5 Bq L⁻¹, for 5, 10 and 15°C temperature, respectively. The slightly higher value of radio iodine in the drinking water of Zaboul city in case samples relative to control samples may be due to the use of temperature for case samples. Heating case samples causes raised radioactivity in Zahedan which support the result of drinking water. Knowledge of temperature variation effect on radio-iodine in water was particularly essential for estimating iodide group, especially I-129 transfer to fluvial systems and for successfully measuring radio-iodine in water studies Before the radiometric measurements, chemical analysis for concentration of Na, Ca and Mg was also carried out along with the measurement of electrical conductivity and pH of the water samples. (*Asian Journal of Applied Sciences* 2 (3): 248-252, 2009; doi: 10.3923/ajaps.2009.248.252)

A Novel and Proven System for Non-Invasive Blood Glucose Monitoring using HbA1C

J. Sundararajan, V. Palanisamy and Mandyam Sandeep

In this study, we present a novel framework for blood glucose level measurement using a combination of the HbA1c test and the stable, accurate Photo Acoustic methods to get an absolutely consistent and precise, non-invasive technique. The setup uses a pulsed laser diode as a source rather than the typical Nd: YAG laser, since it gives a possibility for variable input wavelength pulses. The detector has a double ring sensor as the main module. It is based on the piezoelectric detection. The two ring sensor is used since it has a small opening angle. The detector setup used in this application consists of a ring detector that includes two double ring sensors that are attached to the ring shaped module that can be worn around the finger. The major aim is to detect the photo acoustic signals from the glycated hemoglobin with the least possible error. The proposed monitoring system is designed with extreme consideration to the precision and the compatibility with the other computing devices. The results obtained in this research have been studied and analyzed by comparing these with the results with the *in vitro* techniques like the HPLC. The comparison between the two results has been plotted and it shows a least error. The results also show a positive drive for using this concept as a basis for future extension in quantifying the other blood components. (*Asian Journal of Applied Sciences* 2 (3): 253-274, 2009; *doi*: 10.3923/ajaps.2009.253.274)

A Novel Fast and Efficient Evolutionary Method for Optimal Design of Proportional Integral Derivative Controllers for Automatic Voltage Regulator Systems

S.M.A. Mohammadi, A.A. Gharaveisi and M. Mashinchi

An efficient and powerful design method for calculating optimal Proportional-Integral-Derivative (PID) controllers for AVR systems is proposed. The method is an improved version of the Discrete Action Reinforcement Learning Automata (DARLA) while discrete probability functions (DPF) of the design variables are not considered independent. The results of the proposed method called Extended Discrete Action Reinforcement Learning Automata (EDARLA) are compared to the results obtained by the well known Ziegler-Nichols (ZN), conventional DARLA and Genetic Algorithms (GA) and conventional CARLA approaches. The extensive simulation results prove superiority of the proposed design method in terms of optimality, efficiency, computation burden and being less

sensitive to the ranges considered for the design variables that is the search space. Besides being successful in providing globally optimal results, due to high efficiency and lower computation time, the proposed approach can be considered an interesting candidate for designing and tuning optimal adaptive PID controllers for many practical systems. (*Asian Journal of Applied Sciences* 2 (3): 275-295, 2009; **doi**: 10.3923/ajaps.2009.275.295)

Analysis of Capacitance Networks

J.H. Asad

This study showed that infinite two dimensional (i.e., 2D) complex networks consisting of identical capacitors each with capacitance 1-farad can be analyzed using basic concepts of physics rather than using complicated principles. In this study the equivalent capacitance between adjacent nodes of a square infinite network consisting of identical capacitors each of 1-farad capacitance is determined. The method is applied also to other networks (i.e., triangular, honeycomb and kagome networks). (*Asian Journal of Applied Sciences* 2 (3): 296-299, 2009; **doi**: 10.3923/ajaps.2009.296.299)

Strontium Sulphate Scale Formation in Oil Reservoir During Water Injection at High-Salinity Formation Water

A.B.B. Merdhah and A.A.M. Yassin

This study was conducted to investigate the permeability reduction caused by deposition of strontium sulphate in sandstone cores from mixing of injected sea water and formation water that contained high concentration of strontium ion at various temperatures (50 -80°C) and differential pressures (100-200 psig). The solubility of strontium sulphate scale formed and how its solubility was affected by changes in salinity and temperatures (40-90°C) were also studied. The morphology and particle size of scaling crystals formed as shown by Scanning Electron Microscopy (SEM) were also presented. The results showed that a large extent of permeability damage caused by strontium sulphate that deposited on the rock pore surface. The rock permeability decline indicates the influence of the concentration of strontium ions. At higher temperatures, the deposition of SrSO₄ scale increases since the solubility of SrSO₄ scale decreases with increasing temperature. The deposition of SrSO₄ scale during flow of injection waters into porous media was shown by Scanning Electron Microscopy (SEM) micrographs. The results were utilized to build a general reaction rate equation to predict SrSO₄

deposition in sandstone cores for a given temperature, brine super-saturation and differential pressures. (*Asian Journal of Applied Sciences 2 (4): 300-317, 2009; doi: 10.3923/ajaps.2009.300.317*)

Modeling of a Spark Ignition Engine Combustion: A Computational and Experimental Study of Combustion Process Effects on NO_x Emissions

R. Mobasheri, Y. Fotrosy and S. Jalalifar

In this study, the simulation results obtained by using the AVL FIRE code for a spark ignition (SI) engine are compared with experimental data. Computational fluid dynamics (CFD) is able to significantly reduce the number of experimental tests and measurements and lower the development time and costs. However, some parameters which are needed for CFD calculation must be achieved experimentally such as turbulence length scale. The CFD simulations demonstrated good agreement to the measured data. The Results show that, applying appropriate constants of each combustion model including eddy break up model (Ebu), probability density function (PDF) and coherent flamelet model (Cfm) causes the computational results to be in agreement with experimental results. Furthermore the results show that the nearest prediction in comparison with experimental results is by applying the Ebu model. (*Asian Journal of Applied Sciences 2 (4): 318-330, 2009; doi: 10.3923/ajaps.2009.318.330*)

Studies on Granite and Marble Sawing Powder Wastes in Industrial Brick Formulations

S. Dhanapandian and B. Gnanavel

The main aim of this research is to study the utilization potential of granite and marble sawing powder wastes as alternative raw materials in the production of bricks. To safeguard the environment, efforts are being made for recycling different wastes and utilize them in valuable applications. Granite and marble sawing powder wastes is widespread by-product of industrial processes in India. Generally these wastes pollute and damage the environment due to sawing and polishing processes. Granite and marble wastes were collected from companies located in Salem District, Tamilnadu, India. Local clay and fired industrial brick samples were collected from nearby district namely, Erode, Tamilnadu, India. Mixtures were prepared with amounts of 0, 10, 20, 30, 40 and 50 wt. % of wastes incorporated into the raw clay and then fired at temperatures from 500 to

900°C in steps of 100°C in an electric furnace. Their characterizations were carried out with the determination of particle size, chemical composition, plasticity, XRD, SEM and Mossbauer spectroscopy. The technological properties such as compressive and flexural strengths, water absorption, porosity and bulk density were determined. The results showed that the granite and marble wastes can be added to the clay material with no detrimental effect on the properties of the sintered bricks anticipating no costly modifications in the industrial production line. (*Asian Journal of Applied Sciences* 2 (4): 331-340, 2009; **doi:** 10.3923/ajaps.2009.331.340)

Preparation of Organic Solvent/Surfactant-Free Microspheres of Methoxy Poly(Ethylene Glycol)-*b*-Poly(ϵ -Caprolactone) by a Melt Dispersion Method

Yodthong Baimark

Aim of this research is to prepare organic solvent and surfactant-free microspheres of biodegradable methoxy poly(ethylene glycol)-*b*-poly(ϵ -caprolactone) diblock copolymer. The microspheres were produced in 90-100°C glycerol by melt dispersion method. Morphology of the microspheres was spherical in shape with rough surfaces. Almost microspheres were in the size range of 300-500 μm . Microsphere cross-sections showed condensed phases throughout the microsphere matrices. Melting temperatures and heats of melting of the MPEG-*b*-PCL were decreased in the microsphere form. In conclusion, the use of melt dispersion method results in organic solvent and surfactant-free biodegradable microspheres of diblock copolymer that showing a potentially useful drug delivery systems with free from surfactants and organic solvents. (*Asian Journal of Applied Sciences* 2 (4): 341-347, 2009; **doi:** 10.3923/ajaps.2009.341.347)

Effect of Dynamic Analysis and Modal Combinations on Structural Design of Irregular High Rise Steel Buildings

B.J. Alsulayfani and T.E. Saeed

The aim of this study is to determine the effects of methods of analysis used in the analysis and design of high rise steel buildings. As it known, many methods are available for the structural analysis of buildings and other civil engineering structures under seismic actions. The differences between them lie in the way they incorporate the seismic input and in the idealization of the structure. There are two procedures for specifying seismic design forces: first, the equivalent static force

and second, the dynamic analysis which can take a number of forms. Mode superposition is one of these forms. Design codes have proposed different formulas to obtain a more reasonable estimate of the maximum response from the spectral values (SRSS, CQC, ASCE-98, TEN, ABS, CSM). This research studies the effect of these formulas in the analysis and design of high rise reentrant steel buildings. The study then compares the resulting steel sections weight using static and dynamic analysis, the latter being by means of mode combination methods to show the difference between these formulas, to determine the most influenced structural members and to obtain the vertical loads factor in order to get the required sections using common static analysis for preliminary design purposes. The study shows that modal combination methods slightly affect the result of design for building; the difference among the formulas does not exceed more than 2.5%. The columns especially those at lower floors are mainly affected by seismic forces, while the beams are slightly affected. Finally, a factor of (10.5%) of the total vertical loads (excluding self weight of the building) can be used to predict the members sections, instead of dynamic analysis which is time consuming even with high speed computers like those used in this research. (*Asian Journal of Applied Sciences* 2 (4): 348-362, 2009; doi: 10.3923/ajaps.2009.348.362)

A Study of the Relative Levels and Factors in the Analysis of Total Ammonia Nitrogen in Some Surface and Groundwater Bodies of Swaziland

A.O. Fadiran and S.P. Dube

Water samples from selected surface water systems, namely three major rivers, three industrial discharges, one reservoir, one pond and tap water and groundwater systems made up of fifteen boreholes and shallow wells, were analyzed for ammonia ($\text{NH}_3\text{-N}$), using the UV spectroscopic (Salicylate) method. Pooled mean values ($\text{mg NH}_3\text{-NL}^{-1}$) are 0.14-0.29 for rivers, ponds, reservoirs and tap water; 14.80-16.70 for industrial effluents and 0.11-0.43 for the boreholes and shallow wells. These values are below the recommended maximum contaminant level (MCL) of $<0.6 \text{ mg L}^{-1}$, by USEPA and SWSC (Swaziland Water Services Corporation), for drinking water 1.0 mg L^{-1} for rivers and the 22.8 mg L^{-1} by USEPA for industrial effluent. However, they all exceed the 0.02 mg L^{-1} MCL recommended by USEPA for fish health and aquatic life in general, as well as the 0.1 mg L^{-1} for uncontaminated natural water. The most dominant factors considered in this study to have greatly influenced the levels of ammonia in both surface and groundwater samples analyzed include the degree of agricultural and industrial activities, population density, climate, rainfall pattern and

soil/rock type in the area. More specifically the location (rural, sub-urban or urban) and depth are other factors that influence the ammonia levels in groundwater bodies. (*Asian Journal of Applied Sciences* 2 (4): 363-371, 2009; doi: 10.3923/ajaps.2009.363.371)

Optimization of Some Pre-treatments Involved in the Press Extraction of Shea (*Vitellaria paradoxa* Gaertner F.) Butter

A.M. Mohagir, R. Kamga, C. Kapseu and C.F. Abi

In this study, press extraction conditions of shea butter were optimized. Response Surface Methodology (RSM) using the Doehlert experimental design has been employed in the optimization. The independent variables considered were roasting time (0-90 min), grinding size (1-5 mm squared mesh), cooking time (0-180 min) and cooling time (0-60 min). The linear combination and quadratic effects of these variables on extraction yield, acid value, peroxide value and absorbance at 440 nm were investigated. The extraction yield was significantly influenced by cooking time and roasting time ($p < 0.001$). Acid value was significantly affected by all the mentioned parameters ($p < 0.05$), whereas peroxide value was significantly influenced by grinding size ($p < 0.01$), roasting time ($p < 0.001$) and cooling time ($p < 0.01$). The results revealed that the optimum conditions for extraction yield were grinding size 3.5 mm, cooking time 180 and 54 min cooling time. (*Asian Journal of Applied Sciences*, 2 (4): 372-384, 2009; doi: 10.3923/ajaps.2009.372.384)

New Perfobond Rib Connector Shapes

Ai Rong Chen and S.Y.K. Al-Darzi

The connection between steel and concrete aimed to be enhanced through investigating and developing the composite action affects on overall behavior of composite bridge. Among different types of connectors available today, the perfobond connector is suggested to enhance the connection properties. The push-out test is used to investigate the resistance capacity of the available regular perfobond connector. Several finite element models are developed and verified to simulate the push-out test specimen, shell element, solid element and bar element with both geometric and material nonlinearities. The verified finite element model is then used to test the applicability of the newly suggested connectors, replacing circular holes in the regular perfobond connectors by triangular one. The resistance capacities predicted for the newly suggested shapes seem to be close to that

predicted from the regular perfobond connector. The results indicate that the new connector is applicable and supposed to be more reliable in steel-concrete composite structure, predicting more integrity between concrete. A recommendation on performing more studies on the newly suggested connectors are withdrawn due to the sensitivity of the connector to the dimension and shape of hole. (*Asian Journal of Applied Sciences*, 2 (4): 385-393, 2009; **doi**: 10.3923/ajaps.2009.385.393)

The Effect on Organic Agriculture of Insulation of Rural Houses in Turkey

Sirri Şahin and Abdurrahim Bolukbasi

This present study investigated how much energy and dung savings can be obtained with the insulation of rural houses. Energy savings and dung savings are calculated based on degree-days, fuel types and thermal resistance of walls. The results showed that by enveloping a rural house with proper insulation thickness, energy savings differ between 20 and 86% and payback periods differ between 0.52 and 4.64 years based on degree-days, fuel types and thermal resistance of walls. When rural houses are optimally insulated, the dung savings are calculated as 3970 kton. In return, these savings can directly be used in organic farming. Therefore, insulation of rural houses is crucial for energy savings. (*Asian Journal of Applied Sciences*, 2 (4): 394-401, 2009; **doi**: 10.3923/ajaps.2009.394.401)

Population Projection of Kerala using Bayesian Methodology

Rahul, Gyan Prakash Singh and Om Prakash Singh

This study considers use of Bayesian methodology for the population projection of an Indian Province, Kerala using logistic growth model. The study presents probabilistic projections of the population and estimates of the parameters of the model along with their highest posterior density intervals. Getting actual expressions of posterior distributions in Bayesian setup with large number of parameters is a difficult task. To overcome the problem, Markov Chain Monte Carlo (MCMC) technique has been used for getting samples from the posterior distribution. The projections have been compared with those made in earlier studies to check the suitability of the projections. We have also discussed the asymptotic behavior of population projection to know the total population at which Kerala population will be stabilized. (*Asian Journal of Applied Sciences*, 2 (4): 402-413, 2009; **doi**: 10.3923/ajaps.2009.402.413)

Comparative Study of Synchronizing Unified Fractional Chaotic Systems

Somayeh Jokar

In this study nonlinear controller, active controller, unidirectional coupling controller and active sliding mode controller are designed for synchronizing pairs of unified fractional chaotic systems with known parameters different randomly selected initial conditions. These methods are compared from various points of views such as synchronization time, synchronization error, average synchronization time, average error variance, average squared error variance, average minimum control signal, average maximum control signal, minimum control signal variance and maximum control signal variance. As we know, nobody compares these methods for fractional chaotic systems, until now. Present results show that the active sliding mode controller is generally better than the others according to the defined criteria. (*Asian Journal of Applied Sciences* 2 (5): 414-435, 2009; *doi: 10.3923/ajaps.2009.414.435*)

A New Roughened Bed Hydraulic Jump Stilling Basin

M. Shafai Bejestan and K. Neisi

The main goal of this study is to introduce a new roughened bed hydraulic jump stilling basin. To reach such idea, first a new expression was developed for sequent depth and hydraulic jump length. Then, hydraulic jumps were conducted on a bed of prismatic roughness elements in a rectangular flume in order to investigate the jumps' effects on the characteristics of stilling basins. The roughened elements are glued on the bed of the flume downstream of ogee spillways in such a way that the incoming water jet is just above the element surface. Each rough element shape was tested under different Froude numbers, ranging 4.5 to 12. During each test, the water surface profile, the roller length and the jump length were measured and the longitudes and vertical flow velocity were also measured in some tests. Applying experimental results, the shear force coefficient was found. The results indicate that the presence of a rough element can increase the shear force and, consequently, reduce the jump length and sequent depth of flow. Comparison of the results with previous studies shows that using the new roughened bed, the length of the basin can be decrease as low as 40% of the regular basins. (*Asian Journal of Applied Sciences* 2 (5): 436-445, 2009; *doi: 10.3923/ajaps.2009.436.445*)

Fire Propagation and Strength Performance of Fire Retardant-Treated *Hibiscus cannabinus* Particleboard

K. Izran, A. Zaidon, A.M.A. Rashid, F. Abood, M.J. Saad, Mohd. Z. Thirmizir, Khairul Maseat and S. Rahim

The fire propagation and strength performance of kenaf (*Hibiscus cannabinus*) core particle board treated with three different commercialized fire retardants were studied using ten percent concentration of fire retardants. The fire propagation test was evaluated using performance index (I), which indicates the heat release of the tested particle boards. Physical and mechanical properties such as water absorption, thickness swelling, Modulus of Rupture (MOR), Modulus of Elasticity (MOE) and Internal Bond (IB) of the treated and untreated boards were also studied. The study showed that diammonium phosphate (DAP) was excellent in reducing the heat release of the boards followed by monoammonium phosphate (MAP) and BP[®] [mixture of 27-33% boric acid, 67-73% guanlyurea phosphate and 0.0-4.2% phosphoric acid]. DAP and MAP were able to delay the maximum early heat release of the boards by about 15 to 16 min and 18 to 20 min, respectively compared to BP[®] which was only able to delay the maximum early heat release by about 10 to 15 min after ignition. The heat release of the DAP and MAP-treated particle boards started 5 min after ignition, but the heat release of the BP[®]-treated boards started from the beginning of the test. Boards treated with DAP were found comply with the standard ratings for thickness swelling and water absorption test. MAP-treated boards were found comply with the standard rating for MOR and were found to be the best compared to the other treated boards for MOE and IB. However, treated boards complied with the standard ratings of MOE and IB. (*Asian Journal of Applied Sciences* 2 (5): 446-455, 2009; *doi*: 10.3923/ajaps.2009.446.455)

Distribution of Organochlorine Pesticides in Human Breast Milk and Adipose Tissue from Two Locations in Côte d'Ivoire

A. Allé, A. Dembellé, B. Yao and G. Ado

The levels of organochlorine residues in 40 samples of milk and 20 human adipose tissues from two locations in the northern of Côte d'Ivoire were determined. A system of Gas Chromatography with an Electron Capture Detector (CG-ECD) was used for the qualitative and quantitative analysis of the samples. This study revealed in general that the level of pesticides in samples of adipose tissue was higher than that in samples of milk from any source (city or rural). Indeed, while

the average of 2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane (DDT), predominant specie and its isomers in adipose tissue was 10.02 mg kg^{-1} in countryside and 6.93 mg kg^{-1} in the city, it was respectively 0.013 and 0.019 mg kg^{-1} in milk. Qualitatively, the pesticide residues detected in milk samples were Lindane, hexachlorohexane and its isomers, DDT and its metabolites, heptachlor, heptachlorepoxyde, aldrin, endrin, dieldrin and endosulfan α and β . Adipose tissue samples revealed the presence of polychlorinated biphenyl (PCB), Hexachlorobiphenyl (HCB) in addition to pesticides which are found in the milk. Average concentrations of organochlorine pesticides in milk matrix were above the Maximum Residue Limits (MRL) of WHO. Regarding adipose tissue, this trend was also observed, except for DDT and its metabolites whose values were far below the MRL. (*Asian Journal of Applied Sciences* 2 (5): 456-463, 2009; doi: 10.3923/ajaps.2009.456.463)

Forest Change Detection in the North of Iran using TM/ETM+Imagery

S. Smailpour Podeh, J. Oladi, M.R. Pormajidian and M.M. Zadeh

Spatial and temporal dynamics of land use/land cover changes were quantified using TM/ETM+images. Time series were selected for forest cover change evaluate in the North of Iran in 1989-2000. In this study, we used a supervise classification algorithm and five techniques based on thresholding involved radiance/reflectance band differencing, NDVI differencing, tasseled cap, change vector differencing and NDVI ratio. Between five change detection approaches, NDVI differencing approach was the best method for changes detecting occurred in the study area. According to measurements from satellite images, 4843.42 ha were detected in this area in 1989-2000. Man-made expansion in the forest North of Iran has been largely derived by population growth and economic development. Land use maps produced will contribute to both the development of sustainable management land use planning decisions and also for forecasting possible future changes in growth patterns. There is a merit to each of the several land use change detection methods studied and appears to be no single best method in which to perform change analysis. The resulting different spectral response of types of disturbances can be used to classify and forecast natural and man made disturbances and artificial neural network or knowledge-based expert offer further opportunities. (*Asian Journal of Applied Sciences* 2 (6): 464-474, 2009; doi: 10.3923/ajaps.2009.464.474)

Design, Fabrication and Testing of a Swirl Burner for Alpha V-Shaped Stirling Engine

I.M. Yusof, N.A. Farid, Z.A. Zainal, G.B. Horizon, K. Noriman and A. Miskam

This study presents the design, fabrication and testing of a swirl burner that was used as part of the heater head section for a 194 cc. V-Shaped alpha stirling engine. The incorporation of a swirl burner with a stirling engine fulfilled its multi-fuel characteristic, since a hot producer gas from a gasification or combustion of any source of fuel can be utilized including biomass. The swirl burner with two heat input channels was designed based on the swirl number, S , which was calculated as 19.6. The swirl burner was made of 4 mm of mild steel and internally covered with 10 mm of cement. The flare from the mixture of air and Liquefied Petroleum Gas (LPG) was torched through the primary inlet and swirled uniformly through the area of an annulus in between the hot working cylinder and the outer swirl burner. The flame temperature inside the swirl burner was found to exceed 1000°C and produced the hot temperature up to 770°C . The required hot temperature inside the stainless steel expansion-working cylinder of 550 and 650°C was realized by the swirling effect of the flare inside the burner. Like a swirl combustor, the mathematical equation of the swirl number, S was found to be applicable to the swirl burner with the swirling effect only at the area of an annulus. The hot temperature increased with the increase of heater temperature inside the swirl burner and improved the expansion process. (*Asian Journal of Applied Sciences* 2 (6): 475-485, 2009; doi: 10.3923/ajaps.2009.475.485)

A Study of Rainfall Forecasting Models Based on Artificial Neural Network

Karim Solaimani

The present study aims to utilize an Artificial Neural Network (ANN) to modeling the rainfall-runoff relationship in a catchment area located in Iran. The study illustrates the applications of the feed forward back propagation for the rainfall forecasting with various algorithms with performance of multi-layer perceptions. The type of used data in ANN environment was 17 years monthly hydrometric and climatic data. For the operated model 14 years but for the validation/testing of the model 3 years data was applied. The results of this study explored that the capabilities of ANNs and the performance of this tool would be compared to the conventional approaches used for stream flow forecast. The estimated statistical results of the Root Mean Square Error (RMSE) and coefficient of determination (r) measures were calculated for the used models of 1, 2 and 3 consequently: 2.5, 0.47; 1.57, 0.96; 0.2, 0.998. The results extracted from the comparative study

indicated that the Artificial Neural Network method is more appropriate and efficient to predict the river runoff than classical regression model. Efficiency of the used model 1 is facilitated for regular temperature data as input component with using two stations, model 2 for precipitation with using five stations and model 3 for rainfall, average temperature and flow data as participation with using six stations. It is concluded that model 3 provided more accurate and satisfied results than the other used models. (*Asian Journal of Applied Sciences* 2 (6): 486-498, 2009; *doi*: 10.3923/ajaps.2009.486.498)

Optimization of a Quadratic Function under its Canonical Form

A. Chikhaoui, B. Djebbar, A. Belabbaci and A. Mokhtari

The aim of this study is to find the exact solution of a quadratic programming problem with linear constraints of an objective quadratic function written in the canonical form. This study describes a new method which is based on splitting the objective function into the sum of two functions, one concave and the other convex; a new feasible constraint set is built by a homographic transform, in such away that the projection of the critical point of the objective function onto this set, produces the exact solution to the problem on hand. Notice that one does not need to transform the quadratic problem into an equivalent linear one as in the numerical methods; the method is purely analytical and avoids the usage of initial solution. The technique is simple and allows us to find the coefficients of the convex function while moving from one summit to another. The proved theorem is valid for any bound, closed and convex domain; it may be applied to a large number of optimization problems. The obtained results are of great importance to solve separable programming cases. (*Asian Journal of Applied Sciences* 2 (6): 499-510, 2009; *doi*: 10.3923/ajaps.2009.499.510)

VHO Strategy for QoS-Provisioning in the WiMAX/WLAN Interworking System

Omar M. Eshanta, M. Ismail, K. Jumari and P. Yahaya

In IEEE 802.16, one of the main features is the QoS-Provisioning. The limited bandwidth and the increasing of the high data rate service users will impact the performance of the system. In this study, we propose a VHO algorithm that can support the provisioning of QoS in mobile WiMAX networks by handing over some Best-Effort (BE) low-speed WiMAX Subscriber Station (SS) to an overlaid WLAN network subject to the QoS guarantee for the SS. Our simulation results

show that by utilizing the overlaid WLAN hotspots we can gain some free band for the new SS requests. According to our simulation results a significant improvement in the capacity and the probability of blocking (PB) in WiMAX network was achieved. (*Asian Journal of Applied Sciences 2 (6): 511-520, 2009; doi: 10.3923/ajaps.2009.511.520*)

FHSS-FSK Modulator Design and Implementation for a Wireless Sensor Transmitter

Gh. Bouzid, H. Trabelsi, Z. Elabed and M. Masmoudi

This study presents a modulator design and implementation for a wireless sensor transmitter. The transmitter architecture presented combines a Binary Frequency Shift Keying (BFSK) modulator, an up conversion mixer, a power amplifier and an 863-870 MHz bandpass filter. The BFSK modulator uses the Frequency Hopping Spread Spectrum (FHSS) technique operating in the European ISM band 863-870 MHz. This modulator is intended for short-range wireless applications, such as the wireless sensors network. The modulator generates a 7 MHz wide single-sideband frequency hopped spread spectrum waveform. This modulator is designed using the Direct Digital Frequency Synthesizer (DDFS), which enables us to generate BFSK signal with the hopping frequencies. Low power DDFS architecture is presented. It uses a smaller lookup table for sine and cosine functions compared with existing systems using a minimum additional hardware. The evaluated Spurious Free Dynamic Range (SFDR) of the proposed modulator is -88 dBc. A modulator IC has been designed in AMS 0.35 μm standard CMOS process technology with a layout chip area of 0.16 mm^2 . A 20-bit frequency control word gives a tuning resolution of 41.29 Hz at 43.4 MHz sampling rate. This modulator consumes 47.7 μW with a 3V supply at 43.4 MHz. (*Trends in Applied Sciences Research 4 (1): 1-13, 2009; doi: 10.3923/tasr.2009.1.13*)

Reduced-Order Sliding Mode Flux Observer and Nonlinear Control of an Induction Motor

O. Asseu, Z. Yeo, M. Koffi, T.R. Ori, G.L. Loum, T.J. Zoueu and A. Tanoh

This study describes an innovative strategy to the problem of non-linear estimation of states for electrical machine systems. This method allows the estimation of variables that are difficult to access or that are simply impossible to measure. Thus, as compared with a full-order sliding mode observer, in order to reduce the execution time of the estimation, a reduced or third-order discrete-time extended sliding mode observer is proposed for on-line estimation of rotor flux, rotor

resistance and torque in an induction motor using a robust feedback linearization control. Simulations results on Matlab-Simulink environment for a 1.8 kW induction motor are presented to prove the effectiveness and high robustness of the proposed nonlinear control and observer against modeling uncertainty and measurement noise. (*Trends in Applied Sciences Research 4 (1): 14-24, 2009; doi: 10.3923/tasr.2009.14.24*)

Forest Harvesting Problem in the Light of the Information Measures

P. Rupšys and E. Petrauskas

This study presents a new characterization on optimal harvesting problem. By relying on both Gompertz shape stochastic growth model and the Shannon, Tsallis, Kullback, Fisher information measures, the solution of biologically optimal rotation problem is presented and exemplified. As an present experience a real data set is used from the repeated measurements on permanent sample plots of pine stands in Lithuania. All results are implemented in symbolic algebra system MAPLE. (*Trends in Applied Sciences Research 4 (1): 25-35, 2009; doi: 10.3923/tasr.2009.25.35*)

Artificial Neural Network as a Clinical Decision-Supporting Tool to Predict Cardiovascular Disease

Beatrice Fidele, Jayrani Cheeneebash, Ashvin Gopaul and Smita S.D. Goorah

The aim of the study is to use artificial intelligence tools as a clinical decision support in assessing cardiovascular risk in patients. A two-layer neural network using the Levenberg-Marquardt algorithm and the resilient backpropagation have been used in the proposed artificial neural network. It has been shown how this network is efficient in predicting cardiovascular risk in individual patients by using the Long Beach dataset. The use of this new network seems to better address the prediction of cardiovascular disease at an individual level. (*Trends in Applied Sciences Research 4 (1): 36-46, 2009; doi: 10.3923/tasr.2009.36.46*)

Predictive Determination of the Trajectory of an Electric Discharge

Z. Yeo, M. Koffi, O. Asseu, A. Tanoh, D. Konan and B. Koffi

Some discharge models suppose that the discharge is developed mainly according to an electric field's line. In this study, a computer program is built in order to carry

out accurate determination of the electric field's lines. Finite element method is implemented to solve the Laplace equation and then the electric field is derivate. Field's lines are built by successive jumps and their parameters are calculated by a polynomial approximation. Results are successfully compared to empirical formula established by earlier researches in rod to plane geometry. The field's lines and what could be a discharge line for an aerial insulator are also investigated and discussed. (*Trends in Applied Sciences Research 4 (1): 47-55, 2009; doi: 10.3923/tasr.2009.47.55*)

Investigation of Failure and Corrosion in Pipelines and Tanks used in Ice-Cream Factory: The Case Study

R. Bazargan-Lari and Y. Bazargan-Lari

This study describes the reasons of failure and corrosion in pipelines and tanks used in ice-cream factory located in Soltanabad Industrial Region, Shiraz (Iran). The present research shows that the chloride level of the water is an important factor in determining the resistance of stainless steel due to crevice corrosion. Laboratory research shows that for the majority of natural, raw and potable water with pH in the range 6.5 to 8; crevice corrosion of 304/304L is rare below about 200 ppm of chlorides. Also crevice corrosion of 316 to 316L with the same pH is rare below about 1000 ppm of chlorides. Chemical analysis of the water of industrial region shows that it contains 386.36 ppm chlorides. So, the stainless steel pipeline type 304, which is used in the factory did not have any resistance against the crevice corrosion and rapidly corroded from those points which were more susceptible such as welded zone. Since the pipes were corroded around the welded zones, metallographic studies were conducted in this area which revealed that the welds were not of high quality and contained holes in the welded zones as well as imperfections such as lack of diffusion and incomplete penetration. Finally preventing methods of pipelines corrosion is discussed. (*Trends in Applied Sciences Research 4 (1): 56-61, 2009; doi: 10.3923/tasr.2009.56.61*)

Simulating Fatigue Propagation Life of Martensitic Steel

O.O. Ajayi and J. Ikotun

The linear elastic fracture mechanics equation together with that for stress intensity factor range K , was used to develop a fatigue propagation life model, after substituting parameters of material constants. The model was then employed in creating simulation software which can be used at any time to generate data,

make design consideration and predict response to variable loading. This became useful in predicting the life of metal from the point of crack initiation; investigate behaviour to changes in crack sizes and also determine adequate damage tolerance for the metal. (*Trends in Applied Sciences Research 4 (1): 62-67, 2009; doi: 10.3923/tasr.2009.62.67*)

Proximate Composition, Mineral Elements and Anti-Nutritional Factors of *Anisopus mannii* N.E.Br. (Asclepiadaceae)

A.B. Aliyu, A.M. Musa, M.S. Sallau and A.O. Oyewale

Biochemical studies with a view to assess the nutritional potentials of *Anisopus mannii* were carried out by evaluating the proximate composition, mineral elements and anti-nutritional content of the plant. The results showed that the total oxalates, free cyanides, tannins and total cyanides were found to be present at 0.70 ± 0.5 , 6.50 ± 0.41 , 10.55 ± 0.01 and $12.41\pm 7.19\%$, respectively. However, concentration of phytate was very low ($0.017\pm 0.00\%$). Proximate compositions of the plant showed a rich source of crude protein ($8.40\pm 0.17\%$), fats ($8.67\pm 0.63\%$), carbohydrates ($72.57\pm 0.68\%$) and total ash ($10.36\pm 0.22\%$). The plant was also found to contain the following essential minerals: potassium (1700 mg/100 g), calcium (1280 mg/100 g), iron (156 mg/100 g), vanadium (102 mg/100 g), chromium (53.90 mg/100 g), zinc (0.874 mg/100 g), copper (1.43 mg/100 g) and manganese (36.60 mg/100 g). The results of this research indicated that *Anisopus mannii* has nutritional qualities that could provide the users with additional nutrients for enhanced curative process of ill health. (*Trends in Applied Sciences Research 4 (1): 68-72, 2009; doi: 10.3923/tasr.2009.68.72*)

Application of Young Slits Technique: Measurement of the Phase of the Diffracted Field in Optical Domain

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This study presents a new technique to measure the phase difference between two diffracted fields: The field diffracted by a reference object and the field diffracted by an unknown object. For that we use the interferential technique of Young slits. We measured the phase difference between the diffracted fields of two rods of resin. And knowing the phase of the diffracted field of the reference object helps deducing the phase of the field diffracted by the sample. This setup is simple and

it is very strong in the presence of disturbances because both objects are illuminated with the same incident beam. Moreover, this technique allows us measuring the phase of the diffracted field on a wide range of angle so that a high resolution of the image can be obtained. (*Trends in Applied Sciences Research* 4 (2): 73-78, 2009; doi: 10.3923/tasr.2009.73.78)

The Effect of Storage Method on the Vitamin C Content in Some Tropical Fruit Juices

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Loss in vitamin C contents of some fruit juices namely, orange, lemon, lime, pineapple, paw-paw and carrot stored under different conditions was investigated. The juice from the fruit samples were extracted, stored at room temperature ($29\pm 1^\circ\text{C}$) in plastic bottles and in the refrigerator ($4\pm 1^\circ\text{C}$) for 4 weeks. The juices were all analysed for their vitamin C content by oxidation and reduction method. Results revealed that the rate at which vitamin C is lost during storage depends on the type of fruit and the storage method employed. The citrus fruits were found to follow a similar pattern of loss, while other fruits differ from this and among themselves. Loss of vitamin C correlated with pH only for pineapple, pawpaw and carrot, however, this cannot be said to be the controlling factor. *Bacillus subtilis* and *Candida* sp. were isolated from all the juices under both storage conditions, except for orange juice. (*Trends in Applied Sciences Research* 4 (2): 79-84, 2009; doi: 10.3923/tasr.2009.79.84)

The Application of Factor Analysis and Artificial Neural Networks in Predicting Spring Precipitation by Means of Climatic Parameters of the Upper Levels of Atmosphere

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This research aims to study the relationship between climatic large-scale synoptic patterns of the upper levels of atmosphere and rainfall in Khorasan-e Razavi Province. Artificial neural networks and factor analysis were used in this study to predict rainfall in the period between April and June in the province. At the first the relationship between average regional rainfall and the changes in synoptic patterns including the temperature of 700 mb level, the thickness between 500 and 1000 mb levels and the relative humidity of 300 mb level were analyzed. In the selection of these regions, we have considered the effect of synoptic patterns in

these regions on the rainfall in the northeast region of Iran. Then, artificial neural networks model for the period 1970-1997 were taught. Finally, the rainfall in the period 1998-2007 has been predicted. The results show that artificial neural networks can predict rainfall with reasonable accuracy in all years. The root mean-square error of the model was 5 mm. (*Trends in Applied Sciences Research* 4 (2):85-97, 2009; **doi**: 10.3923/tasr.2009.85.97)

Adaptive Control of Chaotic Rössler System via Synchronization

H. Fatehi Marj, R. Asgharian and N. Pariz

In this study, using synchronization approach, chaos control for Rössler system is investigated. Based on essential structure of synchronization approach and using bifurcation diagram, periodic Rössler systems or master systems for both period-one and period-two orbits are found. Adaptive nonlinear feedback method is used to synchronize chaotic slave system with periodic master ones. Stability conditions are discussed analytically based on Lyapunov theorem and numerical simulation results are presented. The proposed method could control the chaotic system with unknown parameters very well. (*Trends in Applied Sciences Research* 4 (2): 98-106, 2009; **doi**: 10.3923/tasr.2009.98.106)

Methoxy Poly (Ethylene Glycol)-*b*-Poly (D, L-lactide) Films for Controlled Release of Ibuprofen

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Biodegradable films of methoxy poly (ethylene glycol)-*b*-poly (D, L-lactide) diblock copolymers (MPEG-*b*-PDLL) containing drug were prepared by solution casting of MPEG-*b*-PDLL and drug in dichloromethane. Ibuprofen was used as a poorly-water soluble model drug. Influences of MPEG-*b*-PDLL/drug ratio and film thickness on ibuprofen-loaded film characteristics and drug release behaviors were investigated. The hydrogen bonding between MPEG-*b*-PDLL and drug were detected from FTIR analysis. From FTIR and differential scanning calorimetric results indicated that the ibuprofen was well distributed throughout the MPEG-*b*-PDLL film matrices. The drug release rates increased as the drug ratio increased and the film thickness decreased. The drug release from the films occurred by drug diffusion mechanism. (*Trends in Applied Sciences Research* 4 (2): 107-115, 2009; **doi**: 10.3923/tasr.2009.107.115)

Some Chemical and Morphological Properties of Juvenile Woods from Beech (*Fagus orientalis* L.) and Pine (*Pinus nigra* A.) Plantations

M. Akgül and A. Tozluoğlu

In this study, carefully selected test materials were taken from juvenile wood *Pinus nigra* and *Fagus orientalis* growing naturally in Turkey. The aim of this research is to determine the chemical and morphological properties of the wood fiber of the *Pinus nigra* and *Fagus orientalis* and the suitability of these properties for pulping. Eight sample trees were taken as four pieces for each species which were collected from Duzce-Dariyeri-Yaylagol region. The test samples were taken from certain parts of tree stems. In these tests, fiber length, fiber diameter, lumen dia cell wall thickness were measured. The felting power, elasticity coefficient, rigidity coefficient, Runkel's proportion, Muhlsteph's proportion and F-ratio were calculated from the wood fiber morphological properties and the effects of these properties on pulp strength properties were investigated. According to the results of this study, it was found that the pine and beech are/aren't suitable for pulping. (*Trends in Applied Sciences Research* 4 (2):116-125, 2009; *doi: 10.3923/tasr.2009.116.125*)

A Comparative Study of Neural Networks and Non-Parametric Regression Models for Trend and Seasonal Time Series

Dursun Aydin

In this study, we will investigate and compare the performance of some forecasting methods for time series with both trend and seasonal patterns. The forecasting performance has been compared with six models and these include: Auto Regressive Integrated Moving Average (ARIMA), Smoothing Spline Model (SSM), Regression Spline Model (RSM), Additive Regression Model (ARM), Multi-Layer Perceptron (MLP) and Radial Basis Function (RBF) network models. The SSM, RSM and ARM are called as non-parametric regression models, whereas MLP and RBF are known as artificial neural network models. For these models, we conducted a comparison based on actual data sets, the number of tourist coming to Turkey. The empirical results obtained have shown that MLP performed better than other models. In addition, the SSM can be considered as an alternative to MLP. (*Trends in Applied Sciences Research* 4 (3): 126-137, 2009; *doi: 10.3923/tasr.2009.126.137*)

Spatial Association of Copper Mineralization and Faults/Fractures in Southern Part of Central Iranian Volcanic Belt

R. Derakhshani and A. Mehrabi

To provide guides for exploration of porphyry copper mineralization at a district scale, we examine the spatial association between known copper deposits and strike-slip faults/fractures in South central Iranian volcanic belt. Studying of aerial photographs and preparing of photogeological map of the study area, beside various image processing techniques, helped us to reveal faults/features of this area. Field reconnaissance and local detailed mapping followed to corroborate the evidence. The integration of remote sensing and field checking resulted in preparing geological map of the area. After converting the map to the raster one, buffers around the faults/fractures are extracted. Then the spatial associations between the porphyry copper deposits and strike-slip faults/fractures are quantified using weights of evidence modeling. The porphyry copper occurrences are associated spatially with strike slip faults/fractures within distances of 1 km. In addition, based on these observations local strike slip faults/fractures related to regional strike slip faults systems are the most important foci for emplacement of copper-bearing porphyritic intrusions in the study area. Taking advantages of GIS, remote sensing technology and weights of evidence modeling, it is detected that the most concentrated place of porphyry copper in southern part of central Iranian volcanic belt is among the faults/fractures and through 1 km around them. (*Trends in Applied Sciences Research* 4 (3): 138-147, 2009; doi: 10.3923/tasr.2009.138.147)

Investigation on Bulk Density of Deposited Sediments in Dez Reservoir

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In this study, the bulk density of fine sediments deposited behind Dez dam (near dam body) in Iran has been quantified by field investigation (one borehole closed to power intakes) and available empirical methods. Dez dam is located in the Southwest of Iran, completed in 1963, with the height of 203 m and original reservoir volume of 3315 million m³ (MCM). The result of bathymetry survey in 2003 show that the storage volume of the reservoir has been reduced to

2600 MCM by sedimentation and sediment level at upstream of the dam body has been raised to 256 m, i.e., only 14 m below the hydropower intake at elevation of 270 m. The field data from a deep borehole at bottom of reservoir close to the hydropower intakes have been collected and analyzed. Results show that the empirical methods proposed by Lane and Miller underestimate the bulk density of sediments by about 43 and 46%, respectively. This shows that the empirical methods can not be applied for predicting bulk density of fine sediments. A new set of equations is developed for predicting the bulk density of fine sediments. (*Trends in Applied Sciences Research* 4 (3): 148-157, 2009; **doi**: 10.3923/tasr.2009.148.157)

Evaluation of Horizontal and Vertical Illuminance Models against Measured Data in Iran

S. Shekari. S and R. Golmohammadi

This study was undertaken to evaluate performance of three models of horizontal and two models of vertical illuminance based on measured data in Iran. Measurement of horizontal and South oriented vertical illuminance was carried out at three stations of Eshtehard, Hamadan and Kerman over 15 days at one hour intervals between 12 July and 1 August 2007 from 9 a.m. to 3 p.m. Synchronously calculation of solar altitudes and global horizontal illuminance carried out utilizing equations proposed by Illuminating Engineering Society of North America (IESNA) for measuring period. Two localized models entitled Solar altitude model and IESNA model in conjunction with the model of Robledo was adopted to predict horizontal illuminance. Also for predicting of South oriented vertical illuminance, a localized model based on IESNA equations in conjunction with a model of Ruiz were taken in to account. Mean measured and predicted horizontal values by three models found to be 96 KLx and 107.3-108.7 KLx, respectively. Among three horizontal models the model of IESNA (MBD = -1.26, RMSD = 10.25) performed best and the model of solar altitude performed worst. Mean measured and predicted values of vertical illuminance by two vertical models found to be 33.59 and 25.71-32.19, respectively. The IESNA model (MBD = -1.4, RMSD = 0.2) performed better than the model of Ruiz. Respective mean monthly predicted horizontal and vertical illuminance exceeded 63 KLx for 50 and 0.96% of working year indicating high daylight availability on horizontal and vertical planes in Iran. (*Trends in Applied Sciences Research* 4 (3): 158-166, 2009; **doi**: 10.3923/tasr.2009.158.166)

Daylight Availability and Energy Conservation in Industrial Parks of Tehran

S. Shekari S. and R. Golmohammadi

This study presents results of a study on estimation of daylight availability on horizontal and south oriented vertical surfaces as well as energy saving in industrial parks of Tehran by daylighting. Beyond our natural affinity for daylight, it is much more effective than electric lighting at entraining the circadian system because the circadian system responds only to high levels of blue light, such as those found in daylight. Horizontal and vertical illuminances were calculated for three established stations by equations of Illuminating Engineering Society of North America. Synchronously illuminances were measured over 15 days between 12 July and 1 August 2007 to confirm calculated data. The correlation of measured and calculated values was reasonable ($r=0.703$). Regression models were developed between measured and calculated values ($r^2 = 0.8$). Horizontal and vertical illuminances were predicted for 11 industrial parks of Tehran during a working year (294 days) by fitted models. The minimum, maximum, mean and SD of predicted horizontal values found to be of 12.45, 108.12, 66.48 and 24.71 KLx, respectively. Considerable frequency of occurrence of horizontal illuminance in all places (9.7%) was related in values more than 100 KLx. Additionally it was revealed that in 55% of working year daylight could be sufficient for maintaining indoor standard illuminance of 500 Lx. Results of this study suggest high daylight availability and high potentiality of energy conservation in Iran. (*Trends in Applied Sciences Research* 4 (3): 167-174, 2009; **doi**: 10.3923/tasr.2009.167.174)

Utilization of Local Raw Materials for the Production of Commercial Glasses

Omar A. Al-Harbi and Mohammad M. Khan

The main objective of this study was to prepare transparent soda-lime-silica and borosilicate glasses utilizing locally available raw materials. Major source of oxides for the preparation of different various glass batches are silica sand, limestone, magnesite, clay, feldspar, granite and nepheline syenite. The mean chemical composition of soda-lime-silica glasses consisted of SiO₂ (70.72%), CaO (10.78%) and Na₂O (16.67%) and that of borosilicate glass consisted of SiO₂ (71.83%), Na₂O (5.30%) and B₂O₃ (13.26%). The Coefficient of Thermal

Expansion (CTE) ranged from 93.64 to $110.78 \times 10^{-7} \text{ } ^\circ\text{C}$ for soda-lime-silica glass and from 44.85 to $73.25 \times 10^{-7} \text{ } ^\circ\text{C}$ for borosilicate glass in the Temperature range of 25-300 $^\circ\text{C}$. A strong correlation was observed between the batch and among other glass parameters such as chemical composition, melting temperature, color, density, microhardness, chemical suitability and coefficient of thermal expansion. The multivariate analysis of major oxides and the different properties of prepared glasses suggest that most of these properties depended on the composition of glasses. The properties of the prepared glasses highlighted the potential of local raw materials for glass industry in the Kingdom. (*Trends in Applied Sciences Research 4 (4): 176-187, 2009; doi: 10.3923/tasr.2009.176.187*)

Trends of Rotational Speed on Engine Performance for Four Cylinder Direct Injection Hydrogen Fueled Engine

M.M. Rahman, M.K. Mohammed and R.A. Bakar

This study was addressed the effect of speed on engine performance for four cylinder direct injection hydrogen fueled engine. GT-Power was utilized to develop the model for direct injection engine. This model was employed one dimensional gas dynamics to represent the flow and heat transfer in the components of engine model. Sequential pulse injectors were adapted to the inject hydrogen gas fuel within the compression stroke. Air-fuel ratio was varied from rich limit (AFR = 27.464) to a lean limit (AFR = 171.65). The rotational speed of the engine was varied from 1000 to 6000 rpm. The obtained results seen that the engine speed are greatly influence on the Brake Mean Effective Pressure (BMEP), Brake Specific Fuel Consumption (BSFC). It can also be seen that the decreases of BMEP with increases of engine speed, however, increases the brake specific fuel consumption. The brake thermal efficiency increases nearby the richest condition and then decreases with increases of engine speed. The optimum minimum value of BSFC occurred within a range of AFR from 38.144 ($\phi = 0.9$) to 49.0428 ($\phi = 0.7$) for the selected range of speed. The higher volumetric efficiency emphasizes that the direct injection of hydrogen is a strong candidate solution to solve the problem of the low volumetric efficiencies of hydrogen engine. Maximum brake torque speed for hydrogen engine occurs at lower speed compared with gasoline. The present contribution suggests the direct injection fuel supply system as a strong candidate for solving the power, torque and abnormal combustion problems. (*Trends in Applied Sciences Research 4 (4): 188-199, 2009; doi: 10.3923/tasr.2009.188.199*)

The Effect of Frequency on the Cyclic Strain Accumulation of Plain Stainless Steel Pressurized Cylinders Subjected to Dynamic Bending Moment

S.J. Zakavi, M. Zehsaz and M.R. Eslami

The aim of this study is to evaluate the effect of frequency on the ratchetting behavior of plain stainless steel pressurized cylinders that may be used in the power plant components. The cylinder is subjected to an internal pressure (calculated as the design pressure for each cylinder) and alternately bending moments at different frequencies typical of seismic events. Ratchetting of the cylinder wall has been observed and recorded in the hoop direction. The nonlinear isotropic/kinematic (combined) hardening model is used to evaluate the ratchetting. Finite element analysis which models the cylinders under above mentioned loads and combined hardening model is applied to investigate the ratchetting. Stress-strain data and material parameters have been obtained from several stabilized cycles of specimens that are subjected to symmetric strain cycles. The results show that initially, the calculated rate of ratchetting is large and then decreases with the increasing of cycles. Also, the ratchetting data using FE analysis show the hoop strain ratchetting decreases with the increasing of frequencies and spacing from the resonant frequency. (*Trends in Applied Sciences Research 4 (4): 200-215, 2009; doi: 10.3923/tasr.2009.200.215*)

Effect of Milling Parameters on Frictions when Milling Hastelloy C-22HS: A FEM and Statistical Method

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This study was developed the Finite Element Model (FEM) and Response Surface Method (RSM) to investigate the effect of milling parameters on frictions when milling Hastelloy C-22HS. This study gain better understanding of the friction distribution in metal cutting process. The RSM was used to minimize the number of simulation. The contour plot from RSM shows the relationship between input variables including the cutting speed, feed rate and axial depth and responses including the friction coefficient, friction angle, friction stress and friction force. Feed rate, axial depth and cutting speed play major role to generate high friction coefficient, friction angle, friction stress and friction force. When all the variables at highest value the friction stress become larger, on the other hand reduce the feed rate and increase other variable, it cause high friction coefficient, angle and force. The combination of numerical analysis and statistical method are very useful to analysis the distribution of friction in milling. It is suitable to use middle

value of cutting speed, feed rate and axial depth when milling same type of materials. (*Trends in Applied Sciences Research* 4 (4): 216-228, 2009; *doi: 10.3923/tasr.2009.216.228*)

Geologically-Constrained Fuzzy Mapping of Porphyry Copper Mineralization Potential, Meiduk District, Iran

R. Derakhshani and A. Mehrabi

In this study the theory of fuzzy sets is developed for geologically-constrained predictive mineral potential mapping. The application of the theory of fuzzy sets involves multi-class predictor patterns of geological features. Using the spatial association between known copper deposits and structural features of the study area which is provided by weights of evidence modeling, maps of fuzzy membership value for strike-slip fault fractures, batholithic pluton margins, pluton centroids, lithologic formations and hydrothermal alteration units are provided. After combination of these layers, zones of porphyry copper potential are provided by using fuzzy gamma operator. This method for geologically-constrained predictive mineral potential mapping indicates that the predicted favorable zones for porphyry copper in the study area comprise 4 areas: good potential (0.35%), moderate potential (0.87%), weak potential (31.9%) and non potential for porphyry copper deposits (66.88%) where some well-known deposits like Meiduk and Sara are located in the favorable potential area. So, the application of the theory of fuzzy sets to mineral potential mapping provides a quantitative yet subjective technique for predicting mineral potential where a number of mineral deposits are known. Also, the application of the theory of fuzzy sets in the generation of geologically-constrained predictive maps of mineral potential can be useful to guide further exploration in the search for undiscovered mineral deposits in the study area. (*Trends in Applied Sciences Research* 4 (4): 229-240, 2009; *doi: 10.3923/tasr.2009.229.240*)

Influence of Co-Doped Bimetallic Impurities on the Metastable Zone Width and Induction Period for Nucleation of KDP from Aqueous Solutions

S.A. Begum and J. Podder

The results of the influence of co-doped bimetallic Mg(II)-Ni(II), Mg(II)-Co(II), Mg(II)-Li(I) impurities on metastable zone width and induction period for the nucleation of KDP crystals are discussed in this study. In order to grow bulk crystals with faster growth rates along all the crystallographic directions, the solubility, metastable zone width, induction period and interfacial energy etc., are

necessary to know to optimize the growth conditions. Metastable zone width, induction period and interfacial energy have been determined. Interfacial energy has been estimated using the experimentally determined induction period values based on the classical nucleation theory for a spherical nucleus. The presence of co-doped bimetallic Mg(II)-Ni(II), Mg(II)-Co(II), Mg(II)-Li(I) impurities is found to enhance the metastable zone width, induction period, interfacial energy and also minimizes the formation of secondary nucleation. This phenomenon may be attributed due to the absorption of impurities on the surfaces of the growing nuclei. (*Trends in Applied Sciences Research* 4 (4): 241-247, 2009; **doi:** 10.3923/tasr.2009.241.247)