ABSTRACTS OF PAPERS PRESENTED AT INTERNATIONAL CONFERENCES

The **a**bstracts of papers published in this magazine pertain to research projects conducted all over I.R. Iran, including those papers which have been previously printed in reputable scientific publications, and are not limited to the Sharif University of Technology alone. The Editor would be happy to include abstracts in future editions of *sharif*, of all scientific papers presented internationally by researchers from throughout the country, with a view to keeping the academic and professional communities informed about research activities carried out by Iranian scientists.

BIODEGRADATION OF POLYCYCLIC AROMATIC HYDROCARBONS (PAHs) BY THE FUNGI ISOLATED FROM COAL TAR CONTAMINATED SOIL*

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ABSTRACT

Microbiological analyses of soil chronically exposed to coal tar of an industrialized area near the city of Isfahan, In Iran, resulted in the isolation of the fungi which degraded, each of, naphthalene, phenanthrene, and anthracene in an aqueous solution, when grown for 2 weeks in pure culture with organic nutrients. The initial PAH concentrations were at water solubility level and degradation proceeded to nondetectable level. They grew well at 25°C to 30°C. The use of these microorganisms may be an attractive alternative to existing physicochemical methods for the remediation of polycyclic aromatic hydrocarbons in the environment.

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EFFECTS OF FLUX ADDITIONS ON INCLUSION, REMOVAL AND MICRO-STRUCTURE IN ELECTRON BEAM BUTTON MELTING OF UDIMET 720[*]

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ABSTRACT

An investigation has been made of the effects of additions of flux on the removal of non-metallic inclusions and on the macrostructure and microstructure developed during the electron beam button melting of alloy udimet 720.

The fluxes used were based on the alumina-lime-silica system and were added either prior to the start of the drip metling procedure or after drip melting into the copper crucible had commenced. Flux additions led to a decrease in the sulphur content of the alloy and to a decrease in inclusion content in the bulk of the button. The distribution of inclusions that collected on the upper surface of the buttons was dramatically modified by flux additions which distributed them to the perimeter of the top surface rather than collecting them into a central 'raft' as occurs in the absence of the flux.

The flux additions also led to a macroscopic change in the shape of the button, giving a concave top surface profile instead of the normal convex form and to a smooth, rather than rough, surface at the button/mould interface. The presence of a molten flux layer between the button and the crucible wall lowered the heat transfer coefficient giving rise to dendritic growth instead of the fine equiaxed chill zone found in buttons melted without flux.

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PERFORMANCE OF AN ANALOGY-BASED ALL-SPEED PROCEDURE WITHOUT ANY EXPLICIT DAMPING[**]

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ABSTRACT

The performance of a numerical method which solves flow at all speeds, and does not use any explicit artificial viscosity or damping mechanism whatsoever, is investigated by testing a number of selected cases in compressible and incomprssible flows. Contrary to existing methods, the momentum components are chosen as the dependent variables instead of the velocity components in order to provide a number of advatages. Among the motivations for this change is a flow analogy which permits incompressible methods to be used to solve compressible flows. The method is formulated within a control-volume-based finite-element approach using a collocated grid arrangement. The definition of two types of mass flux components at the control volume surfaces removes the possibility of velocity-pressure decoupling in the incompressible or Euler limits. In the absence of any dissipation mechanisms, the main concern of this work is to evaluate the performance of the method and the analogy for solving high speed compressible flows with shocks. The results and performance of the present work are compared with the exact and benchmark solutions and the results of other workers who use dissipation mechanisms to solve flow at all speeds.

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PERFORMANCE EVALUATION OF THYRISTOR BASED STATIC TRANSFER SWITCH[*]

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ABSTRACT

Industrial customers are becoming more sensitive to variations of utility supply systems due to the growing demand for process controls in automated plants. One option to increase reliability and quality of ac power is to provide sensitive customers with access to two independent power sources. In this paper, a fast thyristor based Static Transfer Switch (STS) is proposed which employs fast voltage-detection and thyristor gating strategies to connect the customer to either of the two sources. Performance of the designed STS system is evaluated using the ElectroMagnetic Transients for DC (EMTDC). Simulation results are verified by comparing them with experimental results.

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INVESTIGATING DYNAMIC INTER-ACTION BETWEEN THE ONE D.O.F. MANIPULATOR AND VEHICLE OF A MOBILE MANIPULATOR[**]

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ABSTRACT

A manipulator mounted on a moving vehicle is called a mobile manipulator. A mobile manipulator with an appropriate suspension system can pass over uneven surfaces, thus having an infinite workspace. If the manipulator could operate while the vehicle is traveling, the efficiency concerning with the time and energy used for stopping and starting will be increased.

This paper presents the kinematic and dynamic modeling of a one degree of freedom manipulator attached to a vehicle with a two degrees of freedom suspension system. The vehicle is considered to move with a constant linear speed over an uneven surface while the end effector tracks a desired trajectory in a fixed reference frame. In addition, the effects of dynamic interaction between the manipulator and vehicle (including the suspension system's effects) have been studied. Simulation results from straight line trajectory are presented to illustrate these effects.

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ELASTIC FIELDS IN DOUBLE-INHOMOGENEITY BY THE EQUI-VALENT INCLUSION METHOD[***]

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ABSTRACT

Consider a double-inhomogeneity system whose microstructural configuration is composed of an ellipsoidal inhomogeneity of arbitrary elastic constants, size and orientation encapsulated in another ellipsoidal inhomogeneity, which in turn is surrounded by an infinite medium. Each of these three constituents in general possesses elastic constants different from one another. The double-inhomogeneity system under consideration is subjected to far-field strain (stress). Using the equivalent inclusion method (EIM), the

double-inhomogeneity is replaced by an equivalent double-inclusion (EDI) problem with proper polynomial eigenstrains. The double-inclusion is subsequently broken down to single-inclusion problems by means of superposition. The present theory is the first to obtain the actual distribution rather than the averages of the field quantities over the double-inhomogeneity using Eshelby's EIM. The present method is precise and is valid for thin as well as thick layers of coatings, and accommodates eccentric heterogeneity of arbitrary size and orientation. To establish the accuracy and robustness of the present method and for the sake of comparison, results on some of the previously reported problems which are special cases encompassed by the present theory, will be reexamined. The formulations are easily extended to treat multi-inhomogeneity cases, where an inhomogeneity is surrounded by many layers of coatings.

Employing an averaging scheme to the present theory, the average consistency conditions reported by Hori and Nemat-Nasser (1993) for the evaluation of averge strains and stresses are recovered.

BIAS SPUTTERED Ta MODIFIED DIFFUSION BARRIER IN Cu/Ta(V_b)/ Si(111) STRUCTURES*

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ABSTRACT

In this investigation, we have fabricated Ta(V_b)/Si(111) and Cu/Ta(V_b)/Si(111) systems using a DC bias sputtering technique at high Ar pressure (100 mTorr). For Ta/Si(111) system, tantalum layer was formed under various bias voltages ranging from 0 to -150 V. The films were characterized by Rutherford backscattering spectrometry (RBS), scanning electron microscopy (SEM) and four-point probe sheet resistance measurements (R_s). From electrical resistivity and SEM data. A minimum resistivity ($99\mu\Omega$-Cm) and well surface morphology at an optimum bias voltage (V_b=-50V) was obtained for the Ta(V_b)/ Si(111) system. The Ta films deposited under these conditions with 50 nm thickness are then used as a diffusion barrier in the Cu/Ta(V_b)/Si(111) multilayer structure. According to our RBS, SEM and R_s analysis, the Ta barrier layer formed under the controlled bias sputtering at high Ar pressure has demonstrated an improved Ta structure with excellent thermal stability up to 650°C for the Cu/Ta(V_b)Si(111) system annealed in N_2 environment for 30 min. Formation of $TaSi_2$ was observed at 700°C after the barrier failure using RBS spectra.

DESIGNING A GENERAL NEURO-CONTROLLER FOR WATER TOWERS**

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ABSTRACT

This study deals with the capabilities of artificial neural networks in learning to control water towers of different structural properties that are subjected to earthquakes. To this end, water towers were considered as single-degree-of-freedom systems. First, a number of water towers of different structural properties were controlled by the predictive optimal control method, and then the data collected through this control were used in the training of a general neural network controller, called the general neurocontroller. Capabilities of the general neurocontroller were tested in the control of a number of water towers with structural parameters different from, but in the range of, those used in its training. One of the aims of this

study was the introduction of general neuro-controllers as ready-to-use devices that may be used in the design of actively controlled structures, in this case, water towers. Results of this numerical study were promising.

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YBa$_2$Cu$_3$O$_{7-\delta}$-Ag SPUTTERED THIN FILMS ON MgO(100) AND LaAlO$_3$(100) BIASED AND UNBIASED SUBSTRATES*

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ABSTRACT

In this investigation, we have deposited YBa$_2$Cu$_3$O$_{7-\delta}$-Ag thin films on various biased and unbiased substrates, including MgO(100), LaAlO$_3$(100) and Si(111), using a single stoichiometric composite target of YBa$_2$Cu$_3$O$_{7-\delta}$ with 10 wt% Ag content, applying DC sputtering technique. The growth parameters are varied as following: sputtering gas pressure P_{As} = 100 - 300 mtorr, sputtering power P = 30 - 80 W, substrate bias voltage V_b = 0-220 V and film thickness t = 500-5000 Å. An optimum bias voltage of V_b = -100 V was obtained under our experimental conditions. The post annealed (930 $^\circ$C for 1 hr in O$_2$ environment) films exhibit superconducting state with T_c (onset) of about 40 K for biased (on-axis), and 86 K for unbiased (off-axis) post annealed (800 $^\circ$C, 3hr) films grown over both MgO(100) and LaAlO$_3$(100) substrates.

According to our SEM analysis, Ag particles are uniformly distributed in the annealed films with average grain size of about 0.3 μm located mostly at the grain boundaries. PIXE compositional analysis of the deposited films indicated deficiency of Cu and Ba for unannealed and Cu rich concentration for the annealed YBCO-Ag films grown over unbiased LaAlO$_3$(100) substrate.