# ABSTRACTS OF PAPERS IN ENGLISH

## SURFACE REACTIONS IN ALUMINUM DUST COMBUSTION AND BURNING TIME

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**Abstract**
Contrary to previous common theories, which supposed that Aluminum combustion ocurred frequently in the vapour phase, recent research indicates, in some conditions, combustion reactions have an effective role in the development of the combustion process.

There are different methods to determine the role of the combustion of solids and gas in metal particle combustion. One of them is analyzing the time of combustion and it's changes with particle diameter and it's sensitivity towards the amount of oxygen. Experiments indicated that the role of solid - gas reaction at a size below 50 microns is stronger than the gas - gas phase reaction.

## STATIC BUCKLING OF CIRCULAR CYLINDRICAL PIEZOELECTRIC SHELLS BASED ON HIGHER ORDER THEORIES

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**Abstract**
In this paper, static buckling of piezoelectric cylindrical shells is investigated using a higher order theory. Thus, in contrast to the classical theory, transverse shear stresses are also considered. The proposed formulations can be used for both thin and thick shells. Influences of the initial deformations, that are assumed to be in the radial direction, are considered in the formulations. Since a Hermition element is used in the present analysis, displacement -based, as well as stress -based, boundary conditions can be applied. Finally, influence of the applied electrical potential on the inner and outer surfaces of the piezoelectric cylindrical shell is investigated on the buckling load

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## A NEURAL NETWORK BASED ACCELERATION TECHNIQUE OF GENETIC ALGORITHM CONVERGENCE IN AERODYNAMIC DESIGN OPTIMIZATION

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**Abstract**
Wing section optimization is accomplished using a combined strategy consisting of a genetic algorithm (GA) and an artificial neural network (ANN). A real coded genetic algorithm is utilized for an optimum search in design space. The numerical solution of inviscid flow governing equations is used for evaluation of the design candidates. In order to reduce the number of these time consuming evaluations required by GA, every M generation, all chromosomes fitness are trained to a neural network. Then, a control based genetic local search is handled by ANN as a fitness estimator to find new promising regions in design space. It is demonstrated that this approach could save considerable computational time in application fields, such as aerodynamic design. Results are presented for a constrained optimization of an airfoil at transonic flow conditions. The PARSEC method of airfoil generator and unstructured grid movement technique are used in this work. Eventually, optimum airfoil geometry is achieved by about 50% less computational effort compared with the conventional GA method.

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## NUMERICAL INVESTIGATION OF INLET BAFFLE FEATURES EFFECTS ON THE HYDRAULIC PERFORMANCE OF PRIMARY SETTLING TANKS

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**Abstract**
Circulation is created in some parts of the settling tanks. It can increase the mixing level, decrease the effective settling and create short circuiting from inlet to outlet. All the above-mentioned phenomena act in such a way to decrease the tank's hydraulic efficiency, which quantitatively shows how flow within the tank is uniform and calm. So, the main objective of the tank design process is to avoid forming a circulation zone, which is known as the dead zone. Prediction of the flow field and size of the recirculation zone is the first step in the design of settling tanks. In this paper, while the FTC (Flow Through Curve) was introduced, by using the RNG $k-\epsilon$ turbulence model, the effects of inlet position on the hydraulic performance of primary settling tanks were investigated. The baffle presence effect was also studied.

Results show that the RNG $k$–$\epsilon$ turbulence model can predict the curvature of streamlines correctly. It is also shown that the inlet baffle is not useful for the present case-study and reduces its performance.

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## COSMPARING FULL AND REDUCED METHANE KINETICS MECHANISMS IN NUMERICAL MODELING OF POROUS BURNERS

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**Abstract**
The present paper compares full kinetics mechanisms in the numerical modeling of porous radiant burners (PRB), with their reduced forms. The two most frequently used mechanisms of methane combustion (GRI3.0 and Miller) were selected and their effects were examined on temperature, species concentration, burning speed and pollutant emission. While the findings of the numerical simulation of PRB show a fine concurrence between each full mechanism and its related reduced mechanism, no significant temperature differences are observed in the results of full mechanisms. However, CO concentration along the burner axis shows a small difference between two full mechanisms, which is related to HCO and HO2 concentrations. The inconsistency is more pronounced for NO concentration along the porous axis, which is due to prompt NO evaluation. The present research finds deviation, also, between burning speeds, calculated by numerical simulation and experimental results. This difference is much more significant in rich mixtures. The GRI3.0 mechanism estimated the burning velocities as being closer to the experimental values than those predicted using the Miller mechanism.

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## AN ANALYTICAL MODEL FOR EXPANSION AND DEPOSITION OF CHARGED SPRAY DROPS

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**Abstract**
An analytical model is developed accounting for the expansion of an electrically charged spray, further to its temporal deposition on a target. The model employs the Gauss law to determine the electric field that arises from the charged spray, bounded by an earthed control surface. This, in turn, provides the electric force field acting on the spray drops, leading to the spray transient concentration. The concentration field, in combination with the electric field, results in a theoretical relation, which represents a deposition time constant as an index of the charging effect. The dependence of the time constant on a drop electric charge approves the positive role of a charged spray on improvement of the deposition within a shorter time interval. Although an increase in the spray concentration, as well as the use of larger drops, also enhance the deposition, this enhancement indirectly stems from an increase in the drop charge, which occurs due to those factors. The results obtained from the model are also verified against the direct solution of the Poisson equation.

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## DEVELOPMENT OF A NEW METHOD FOR DESIGN OF ADAPTIVE LEAD-LAG CONTROLLERS

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**Abstract**
A new method for the design of self-tuning adaptive lead-lag compensators is developed. The application of this method to a nonlinear robot system, where a linear control theory has not been successful, is presented. The self-tuning block uses a set of linear algebraic equations to solve for compensator parameters. This control strategy takes into account the nonlinear terms of the system and the application of this method reduces the manufacturing costs of automatic control systems that have high accuracy and performance.

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## NUMERICAL SIMULATION OF INVISCID FLOW AROUND HOVERING HELICOPTER ROTOR UNSING UPWIND SCHEME ON UNSTRUCTURED MESHES

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**Abstract**
This paper presents an upwind solution of compressible inviscid flowfield around a helicopter rotor in

hover, using Roe's scheme on unstructured tetrahedral meshes. Higher order differences are computed using a high-order Monotone Upstream Centered Conservation Law (MUSCL) method. The numerical algorithm utilizes an explicit time integration scheme and the solution is accelerated by applying the implicit residual smoothing at every stage of time integration. To demonstrate the solution accuracy, the numerical simulations of the flowfield around an isolated helicopter rotor, in hover, for two operating conditions of subsonic and transonic tip Mach numbers of 0.44 and 0.877, with a blade pitch angle of 8 deg, are performed. The present results for aerodynamic characteristics, including the pressure distributions at different sections of the blade, are compared with numerical and experimental results. The effects of the spatial solution accuracy of the numerical method on the flowfield characteristics and aerodynamic results of the rotor are also studied.

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## ANALYSIS OF EFFECTIVE PARAMETERS ON A ROTARY DESICCANT WHEEL PERFORMANCE

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### Abstract
Input wet air or process air is dried in a rotary dehumidifier, using solid desiccant particles that are a means to the dehumidification of indoor air. The humidity amount on the surface of the desiccant is increased during the dehumidification process and is adsorbed by a regeneration air stream, which is ultimately exhausted to ambient.

In this study, the effect of the Ackermann heat transfer correction factor was investigated by using mathematical modeling of a solid desiccant wheel, as well as mass, energy and momentum balances on air and wet solid particles of the desiccant for the process and regeneration of an air stream. The results indicated that the dehumidification rate, along with the desiccant wheel is dependent on humidity ratio, air velocity and the mass and heat transfer from the air stream to the desiccant bed and the Ackermann correction factor. By increasing the input air relative to the humidity and temperature by more than 50% and 95°C, the respectively, the ackermann factor corrects the heat transfer coefficient by up to 4%. The comparison between the amount of humidity ratio, exit and inlet temperature and air stream velocity, in the adsorption part of the rotary desiccant wheel showed that the velocity of the exit air stream from the wheel is increased, due to the variation of humidity, temperature and pressure depletion. This mathematical model is also capable of depicting the details of superficial humidity and the temperature of the air stream into the desiccant wheel channels in both adsorption and regeneration parts, as periodic profiles.

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## CALCULATION OF THE HYDRODYNAMIC COEFFICIENTS OF TWO-DIMENSIONAL SHIP SECTIONS

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### Abstract
In this paper, a calculation method of hydrodynamic coefficients of two-dimensional ship sections for heave and sway motions, in cases of deep water and zero-forward speed, are discussed. In this method, sections can be in different geometrical shapes. For this purpose, a potential solution with multi pole expansion and two-parameter Lewis conformal mapping, has been used. Using this method, a code is developed that is capable of calculating added-mass and damping coefficients of cross - sections. Also, the results of the code for circular, triangular and rectangular sections are in good agreement with experiments. Therefore, the developed code can be used for hydrodynamic calculations of ships with any arbitrary hull form.

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## INVESTIGATION OF SCALE EFFECT CORRECTION FACTOR IN SHIP RESISTANCE MODEL TEST

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**Abstract**
In small towing tanks, due to tank and model dimension limitations, tests has been performed at low Reynolds number and laminar flow regimes. In this condition, flow momentum is low and as a result, the probability of flow separation is high. This has been resulted to a difference in flow behavior around the model and prototype. Therefore the scale effect in model testing cannot be avoided, which will be grater in small towing tanks. For correction of results in all towing tanks, the scale effect correction factor has been used.

This paper is a result of tests done on a model of a 35000 tons Product Carrier. Tests have been done with and without a turbulent simulator and the scale correction factor for both conditions has been evaluated. Results show that, without a turbulent simulator, this factor approximately has been changed linearly. And, in the case of using a turbulent simulator, the amount of this factor decreased extremely and varied nonlinearly.

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## ACCURATE SHOCK CAPTURING BY SELECTION OF A SUITABLE ARITIFICAL VISCOSITY

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**Abstract**
The addition of a fictitious term, artificial viscosity, into the inviscid Euler equations of fluid dynamics, in order to automatically "capture" shock waves, is, perhaps, the oldest numerical device in the relatively new field of computational physics and mechanics. Many different functional forms for artificial viscosity have been proposed. These forms contain problem-sensitive-constants that are often set in a somewhat arbitrary manner. The purpose of this work is to choose a suitable form to remove as many of these arbitrary constants as possible.

For this purpose, a form presented by Caramana is selected. This form has some important properties, namely; dissipativity, Galilean invariance, ability to distinguish between shock waves, adiabatic compression and turning off completely for rigid motion. Properties are enforced to this form by use of a limiter. Numerical results show more accurate shock wave capturing in non-planar spaces, especially in the convergent cases, than in the other forms of artificial viscosity.

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## NUMERICAL ANALYSIS OF A GEOTHERMAL SNOW-MELTING SYSTEM ON A TYPICAL BRIDGE

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**Abstract**
A geothermal snow melting system consists of hydronic tubes embedded at critical points of roads, highways and bridges. A fluid can be heated by using a ground source heat pump system (GSHP) and circulated through the embedded pipes to prevent freezing conditions on the surface. The goal of this paper is to find practical techniques to decrease the operation time of heat pumps to save energy. This paper consists of a 2D parametric simulation of a typical bridge, considering the weather of Tehran.This simulation contains different parametric inputs, like physical properties and geographical conditions.One important characteristic of this paper is the consideration of different layers and materials in the bridge.