Abstracts of Papers in English

THERMAL COMFORT DESIGN OF A RESIDENTIAL ROOM USING THE INVERSE METHID

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Key Words: inverse thermal design, human body, residential room, natural convection, radiative heat exchange, thermal comfort.

Abstract

A new method to design the human thermal environment is presented in this study. The principle aim of this work is to find thermal comfort conditions for a sited person in a residential room by an inverse method of determination of the air and wall temperatures. The equation set obtained from the inverse modeling is ill-posed so, the first-order Tikhonov regularization method has been employed to well pose the mentioned equation set. The method leads to suitable solutions that satisfy the thermal comfort conditions within an acceptable accuracy and uniformity level without having any problems related to asymmetric radiation discomfort.

IMPROVEMENT OF CONTRACTION PRESSURE DISTRIBUTION TO REDUCE WIND TUNNEL TURBULANCE INTENSITY

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Key Words: wind tunnel, contraction, pressure gradient, turbulence, trip strip.

Abstract

One of the main applications of wind tunnels is to produce a controllable and steady flow with minimum turbulence intensity in its working section. Instabilities and separation of flow in the inlet and outlet of the contraction are the main factors in increasing turbulence intensity in the test section. Forced transition using a trip strip is a suitable method for turbulence reduction in wind tunnels. In this investigation, subsonic wind tunnel experiments were conducted to study the effect of a tripped boundary layer on pressure distribution in the contraction region of the tunnel. Measurements were performed by installing a trip strip at four different positions in the convex portion of the contraction. The results show that installation of the trip strips has a signifi-

cant effect on both turbulence and pressure distribution. The reduction in free stream turbulence and wall static pressure distribution was significantly affected with the location of the trip strip. For example, at X/L=0.79, the unfavorable pressure gradient is weaker and the instabilities are less than at other positions. Consequently, for this position, the lowest amount of turbulence intensity in the test section is obtained.

THE EFFECT OF FERRITE GRAIN SIZE ON MECHANICAL PROPERTIES OF DUAL PHASE (FERRITE-BAINITE) STEELS

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Key Words: ferrite grain size, mechanical property, dual phase steel.

Abstract

In this research, the effect of ferrite grain size on mechanical properties of dual phase (ferrite-bainite) steels was investigated. Dual phase microstructures with different ferrite grain size were produced by heat treatment of AISI 4340 steel. The ferrite volume fraction was approximately constant and about 34% in all produced dual phase microstructures.

Tensile test results showed that both tensile and yield strengths decreased with increasing ferrite grain size, according to a Hall-Pech type relationship. Total elongation was also decreased by increasing ferrite grain size, while uniform elongation increased. Impact energy was also increased with decreasing ferrite grain size.

FLEXIBILITY AND STRESS CONCENTRATION FACTORS IN PIPE BENDS UNDER COMBINED LOADINGS

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Key Words: pipe bend, in-plane bending, flexibility, stress concentration, combined loading.

Abstract

The structural behavior of smooth pipe bends as a curved tube under in-plane and out-of plane bending moments with and without internal pressure, is investigated. Flexibility and stress concentration factors under such loadings are considered as characteristic parameters. These parameters are evaluated under variations of geometrical parameters and loading conditions using the finite element method; results are presented by diagrams. Also, the results obtained in the present study are compared with theoretical and approximate relations that exist in other references, and agreements or differences are indicated.

NUMERICAL SIMULATION OF 3D HYDROCARBON RESERVOIRS USING BLACKOIL MODEL AND AN IMPLICIT FINITE DIFFERENCE METHOD

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Key Words: multi phase flow, porous media, fully implicit finite difference method, three dimensional simulation, hydrocarbon reservoir.

Abstract

In this paper, a numerical method has been presented for hydrocarbon reservoir simulation in three-dimensions using a black-oil model. Here, it is assumed that reservoir fluid contains three-components (oil, gas and water), which can be present in three phases (Oil, Vapor and Aqua). Temperature effects are neglected, but rock compressibility and capillary pressure are included in the physical model. Governing equations for both saturated and under-saturated cases are presented. A finite difference numerical algorithm is devised to solve the problem. The equations are discretized using a cell-centered difference scheme in space and a backward Euler scheme in time. The linearization technique and details of the solution algorithm are presented. Two SPE comparative study problems, i.e. SPE-1 and SPE-8, are solved to verify the accuracy of the proposed method using existing scientific data. The numerical results obtained in this work are in good agreement with results obtained by some other commercial software.

UTILIZATION OF VOF INTERFACE RECONSTRUCTION METHOD TO DEVELOP THE PPM METHOD FOR MULTIMATERIAL PROBLEMS

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Key Words: interface tracking, volume of fluid(VOF), mixture model, piecewise parabolic method (PPM).

Abstract

Careless attention to interfaces may causes rigorous errors in the numerical simulation of multimaterial flows, even in high resolution numerical methods such as the PPM.

"To avoid this problem, interface tracking methods are used. In these methods, the position and geometry of interfaces are determined in each time step. Then the properties of mixed cells are calculated by specific relations that are named mixture model". In the present work, the PPM Godunov type method of Colella is implemented to solve a compressible flowfiled composed of two different fluids. Among several proposed interface tracking methods, the VOF method is selected.

Two mixture models; the "isobar-isoenergy" and the "constant volume fraction", are used, and the results of their implemetation are compared. The results indicate the importance of using a tracking method for multimaterial flow filed simulation. Current study shows that the "isobar-isoenergy" model have a better performance, with respect to the "constant volume fraction" method.

INVESTIGATION EFFECT OF CO-ORDINATED AGENT ON MAGNETIC PROPERTIES OF HEXAGONAL BARIUM FERRITE NANO POWDER PRODUCED BY SOL-GEL COMBUSTION METHOD

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Key Words: nanoparticles, sol-gel combustion method, complexing agent,magnetic properties, barium hexaferrite.

Abstract

In the sol-gel combustion method, the types of precursor used to manufacture magnetic nano powder, are so important. Among these, the coordinated agent has affected particle size, calcination temperature and the magnetic properties of hexagonal barium ferrite nano powder. By considering the role of coordinating agents on the magnetic properties of particles produced by the sol-gel combustion method, in this paper, the effects of coordinated agents, such as citric acid and glycine during the sol-gel combustion step, on the structural, phase and magnetic properties of produced ferrite powders, were studied. The resultant powders were investigated by XRD, SEM and VSM measurement. The single domain size of $BaFe_{12}O_{19}$ powder with crystallite sizes less than 31nm was produced using a glycine precursor and 900°C as the sintering temperature.

PREDICTION OF THE BLANK SHAPE AND FORMING SEVERITY IN GENERAL STAMPING PARTS BY USING THE INVERSE FINITE ELEMENT METHOD

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Key Words: stamping, deep drawing, finite element method, initial blank shape, formability.

Abstract

The purpose of this work is to introduce a quick tool for prediction of the blank geometry and forming severity in the stamping of general sheet metal parts. In this method, formability is evaluated by the prediction of wrinkles and splitting at the stage of design. In other words, having the 3D part geometry, the mechanical properties of the material and the physical conditions, all the mentioned goals can be achieved. To achieve this goal, the total deformation theory of plasticity has been employed. As the original position of the blank is on the horizontal plane, the vertical movement of each node during the deformation is known. Therefore the problem can be evaluated as a 2D problem. Also, to find an appropriate guess at the early stages of computation, a special unfolding technique has been used. The solution provides not only the optimum blank shape geometry, but, also, all the components of the strain. The results of the analyses for some industrial parts have been compared with some published experimental data and results obtained by other commercial software.

A SINGLE PHASE APPROACH TO DESIGN, TEST AND COMPARE THE PERFORMANCE OF AN INDUCTION TWO-FLUID NOZZLE

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Key Words: spray droplet, specific electric charge, induction charging, choking, two-fluid nozzle.

Abstract

An induction internal-mixing two-fluid nozzle has been investigated. The nozzle design takes account of a single phase fluid mechanics viewpoint, in conjunction with the performance characteristics of a benchmark nozzle, which provides an approximate approach to the liquid conduit and the air throat parameters. The approach has been evaluated using an experimental setup capable of a simultaneous and steady supply of compressed air, liquid feed and high voltage to the nozzle. The compressed air plays a crucial role as a dielectric layer on the charging electrode, while the charging voltage improves the induction charging mechanism through strengthening the electric field intensity. At a constant voltage, there exists an optimum air pressure leading to a maximum spray specific charge, beyond which the charging efficiency declines. Although an increase in the liquid flowrate degrades charging efficiency, due to electrode wetting, it would be postponed to greater flowrates by applying higher air pressure. The nozzle performance, in addition to comparing well with the benchmark nozzle, shows a larger spray specific charge at higher pressures and voltages, as well as having the lower consumption of compressed air under all similar conditions.

MODELING IMPACT ENERGY OF FUNCTIONALLY GRADED STEELS WITH CRACK DIVIDER CONFIGURATION

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Key Words: functionally graded steels, impact energy, crack divider configuration, mathematical model.

Abstract

Functionally graded steels were produced via an electroslag remelting process using plain carbon and austenitic stainless steels as electrodes. The charpy impact resistance of functionally graded steel specimens in the form of a crack divider was investigated. The results obtained show that the impact energy of specimens depends on the type and volume fraction of the containing phases. According to the hardness profile and the area under the stress-strain curve obtained from the tensile test, two mathematical models have been presented for predicting the impact energy of specimens using the rule of mixtures. There is good agreement between experimental results and those acquired from two models.

HYDRODYNAMIC PERFORMANCE OF THE SURFACE PIERCING PROPELLERS (SPP) USING BOUNDARY ELEMENT METHOD

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Key Words: surface piercing propellers, boundary element method, hydrodynamic performance.

Abstract

Nowadays, SPP (surface piercing propellers) are employed for many high speed planing crafts with high efficiency and excellent maneuverability. These types of the propeller are working at two interface physical conditions (air and water) and hirgh RPM, so, calculation of the hydrodynamic performance of the SPP are very complicated job. There are some geometrical and physical parameters that are affected to the hydrodynamics performance. The important parameters which effect to the performance are defined, such as; number of blades, pitch, immersion ratio and shaft inclinations, etc. We applied the boundary element method (BEM) and especial boundary conditions taken from experimental data by Ferrando et al.[1−5] for solving the hydrodynamic performance of the SPP. Two propellers, SPP-101 and SPP-102, are selected for calculation of hydrodynamic performance at various conditions. The predicted numerical results show that the present method is a good computational tool for computations of the hydrodynamic characteristics of SPP.

NUMERICAL MODELING OF AIRLIFT PUMP TO OPTIMIZE ITS PERFORMANCE

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Key Words: airlift pump, two phase flow pattern, numerical solution, submergence ratio.

Abstract

In this paper, the influence of performance parameters of airlift pumps, such as: pipe diameter, submergence ratio, flow regimes and pipe length, has been numerically investigated, and the design criteria of the airlift pump have been optimized. The results are compared with the experimental data and show that the present model is in good agreement with other models. The model is used to carry out parametric studies and to optimize the maximum efficiency under various operating conditions. The results show that there is an optimum diameter for a given set of pump operating conditions. The results are discussed for different submergence ratios and tube lengths, in order to increase the efficiency of an airlift pump.

BEHAVIOR MODELS RECONSTRUCTION OF SCARF JOINT OF BIMETAL CAUSED BY BLAST PRESSURE

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Key Words: explosive welding, stand-off distance, scarf joint, impact velocity, blast loading.

Abstract

In this paper, the bonding ability of copper and aluminum with explosion welding was experimentally investigated using different ratio metal thicknesses. First of all, the scarf joint is described, then, all parameters of a table, named the "weld ability window", were calculated. Experimental studies showed that aluminum and copper plates were explosively welded; employing appropriate equations for the explosive loading ratio. The bond strength was investigated using special shear strength tests.

According to shear test results, when the calculated values of minimum plate velocities along the interface were related to the locations in which separation appears, a proper relationship between the explosive loading ratio and the minimum plate velocity is obtained with a correlation factor.

Consequently, the scarf joint not only provides a method of making a bond between dissimilar materials, but, also, is able to evaluate the main equations in the explosive welding process.

EFFECT OF VEHICLE SUSPENSION PARAMETERS ON SUV'S ROLLING STABILITY INVESTIGATION

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Key Words: rollover, dynamic stability index, ADAMS, static stability factor.

Abstract

One of the most serious accidents is rollover. The goal of this research is to investigate the effect of vehicle suspension parameters on a SUV's rolling stability in rollover conditions.

For this purpose, dynamic modeling is determined by consideration of a semi static rollover vehicle in rigid conditions and with suspension systems. After that, the dynamic stability index (DSI) is specified.

To have a comprehensive result, a full vehicle model with 105 degrees of freedom in ADAMS was simulated.

Finally, with the validating model, the dynamic parameters of a suspension system were changed in their specific range, and the effect of those parameters in a rollover critical condition, during a J-turn and fishhook maneuver, has been determined.

For the purpose of the rollover behavior investigation, the Static Stability Factor (SSF) and the Dynamic Stability Factor (DSF) were recorded, and it was determined which parameters were useful for changes in the process of vehicle design, in order to obtain roll stability and a safer vehicle.