ABSTRACTS OF PAPERS IN ENGLISH

DETERMINATION OF SUBSEQUENT YIELD SURFACES USING A COROTATIONAL CONSTITUTIVE MODEL FOR RIGID PLASTIC HARDENING MATERIALS

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ABSTRACT

In this paper, the application of different corotational rates in the constitutive modeling of rigid plastic hardening materials at large deformations is considered. For this purpose, a corotational constitutive model for kinematic and isotropic hardening materials, obeying the von mises yield criterion, is used. By applying this constitutive model, the subsequent yield surfaces are determined for the simple shear problem. It is noted that all corotational rates give the same yield surface for this problem. The yield surface moves in the direction of the stress increment vector for kinematic hardening materials. Also, in the case of combined hardening materials, the motion direction of the yield surface center will become coincident with the stress increment vector as the deformation increases.

IMPROVEMENT OF VEHICLE STEERABILITY BY OPTIMAL DIFFERENTIAL BRAKING

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ABSTRACT

A new method to improve vehicle steerability is

proposed. In this method vehicle lateral velocity and yaw rate are controlled by applying a differential brake torque to the four wheels. In order to decrease the sensitivity of the system to measurement noise, the frequency shaping linear quadratic regulator (FSLQR) method is used. Performance of the proposed controller is demonstrated by simulation of a double lane change manoeuvre. In this simulation, a 14 degree of freedom dynamic model is used for the vehicle, a nonlinear model for the brake system and an analytical model for the tires.

USING THREE DIMENSIONAL UNSTRUCTURED GRID TO SOLVE EULER EQUATIONS

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ABSTRACT

In this paper, grid generation for some simple geometries and solution to the steady state Euler equations representing the inviscid flow over them have been presented. An effective algorithm based on delaunay triangulation has been provided for generating three-dimensional grids. This algorithm includes; boundary point creation, spacing function specification, node creation in the domain and adding these nodes to the grid and finally local refinement of the grid. The improper cases have been rectified elaborately and some suitable solutions for these cases have been presented. The validation of the algorithm has been verified by several grid generation cases and the quality of grids is studied using some suitable criteria. To solve three-dimensional Euler equations, a finite volume cell-center scheme has been used. In order to discretize and validate the code, some examples of supersonic flows have been solved and presented.

STATIC MODELS FOR PREDICTING THE EFFECTS OF SUPPORTS ON MACHINING FLATNESS

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ABSTRACT

This paper presents analytical two and three dimensional static models for predicting the effects of support parameters (including support position, rigidity and preload) on improving machining flatness. In the two dimensional models, the workpiece is modeled as a cantilever or simply supported elastic beam. In the three dimensional model, the workpiece is modeled as a rigid block held in a machining fixture in contact with locators and clamps (in a 3-2-1 scheme) and three supports (in three locating planes) influenced by machining forces and moments. Milling and creep feed grinding experiments are performed to verify the models.

USING A SLIP LINE FIELD IN THE MODELING OF GENERAL SHAPE DEEP DRAWN PARTS

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ABSTRACT

In this work, a new methodology is presented for analyzing the deep drawing parts. This method is based on the slip line field theory. Estimation of blank size, drawing force and forming severity are major results obtained by this method. The effects of friction, bending, unbending and material properties are considered in this approach. Good agreement was found between the theoretical and experimental results.

COLLISION AND PENETRATION OF RIGID SPHERICAL-NOSE RODS IN INFINITE COMPRESSIBLE METAL BODIES

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ABSTRACT

This paper is concerned with the penetration of metal targets by rigid spherical-nose rods under high velocity impact. For this purpose, attention has been focused on compressible, elastic-perfectly plastic targets. Governing equations describing the behaviour of a target in elastic and plastic regions are developed and the results of 6061-T651 aluminum targets are compared with previously published experimental data.

STUDY OF UNSTEADY AIRLOADS INDUCED ON A HELICOPTER BODY DUE TO ITS MAIN ROTOR

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ABSTRACT

The unsteady, incompressible, inviscid and irrotational flow field around a helicopter model in forward flight has been treated numerically, based on singularity element methods. A full three-dimensional modeling of the body, the rotor and its wake is used, in order to study the effects of an operating rotor on the in-flight unsteady airloads induced on the body. This model consists of an unsteady source panel representation for the body and a doublet distribution for the rotor and its shedding wake. A comprehensive code has been developed, based on an iterative coupling method and used for a single rotor helicopter model. Here, the unsteady pressure signatures on the body surface have been calculated due to two known phenomena, i.e blade passage effect and close wake interaction. The computed results show that this code has a fairly good capability for prediction of the complex flow field around a helicopter.

HEAT AND MOISTURE SIMULATION OF A DRYING PROCESS WITH A TWO FLUID MODEL IN A FLUIDIZED BED

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ABSTRACT

One of the most effective processes in drying is the use of a fluidized bed with a hot air stream. In this article, a two- fluid model is used in order to predict the drying rate of products. Hence, the temperature and humidity of grain and gas can be determined. The effect of parameters such as inlet gas temperature and grain diameter is investigated. Experimental data is compared with the model prediction and are shown to be in a close agreement.

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NUMERICAL SIMULATION OF A TURBULENT FILM COOLING FLOW USING STANDARD "k-ε" AND "SHEAR STRESS TRANSPORT" MODELS

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ABSTRACT

Film cooling has many applications such as in gas turbine blades. To increase the efficiency of gas turbines, the temperature of the gas entering the turbine needs to be high. However, the blades have structural limitations and need to be somehow cooled. Film cooling holes are usually installed on the blade's surface, such that, the cooler air makes a film of cooling resistant for the blades. In this work, three-dimensional numerical film cooling of turbulent flow over a portion of a blade (flat plate assumption) is investigated. The flow inside the channel of the hole, along with the flow over the plate, is considered. For turbulent modeling, a k-ε standard model plus a shear stress transport (SST) model are used. For a 90° jet, the results of this research are compared with existing experimental benchmark data and are in relatively good agreements. Also, by comparing the film cooling effectiveness (η) for different speed ratios and different jet angles, their optimum values are obtained.

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KNEE MUSCULAR AND JOINT FORCES WHILST RISING FROM A DEEP SQUAT

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ABSTRACT

In spite of numerous studies conducted on the biomechanics of the knee joint, the muscular and joint forces in activities containing deep flexion have been rarely investigated. In this study, the knee joint forces, whilst rising from a squat position, were analyzed using a two-dimensional model of the lower extremity. The model included the ankle, tibiofemoral, patellofemoral and hip joints, plus nine independent groups of muscles around these joints. The dynamic equilibrium equations for the foot, tibia, femur and patella, yielded a system of indeterminate equation, including 8 equations and 11 unknowns, following the omission or combination of some equations in order to reduce the unwanted unknowns. The required kinematics data were obtained by videography and the surface reaction forces were measured using a force plate. The system of indeterminate equation was solved using non-linear optimization. The sum of the third power of the muscle stresses, which minimizes muscle fatigue, was chosen to be the objective function. Results indicated that the maximum contact force in the tibiofemoral joint was 7.5 times the body weight and occurred at the deepest knee flexion angle. In the patellofemoral joint, the maximum contact force appeared at a 70 degree knee angle, with a magnitude of 4 times the body weight.

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DESIGN OF PLANAR ROBOTIC MANIPULATORS WITH REVOLUTE JOINTS BASED ON THE PSEUDO-ISOTROPY CRITERION

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ABSTRACT

In this paper, the design method of planar redundant robot manipulators is described in such a way that the similar potential motion of the wrist in all directions is achieved. At first glance, the isotropic design seems useful, but the method suffers from a deficiency, namely, the use of an euclidian norm in the joint rate space. By assigning a proper norm to the joint rate space, using the theorem of topological equivalence of all norms in finite dimensional spaces and by introducing some new quantities, the pseudo-isotropy criterion is presented. The results show the superiority of the redundant manipulators with odd degrees of freedom relative to those with even degrees of freedom.

GENERATING A MAXIMUM FEEDRATE MAP FOR ONE-STEP ROUGH FLAT-END MILLING

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ABSTRACT

To increase the performance of a CNC machine, cutting tool-paths should be chosen such that the feedrate can be increased to its maximum possible amount while the force over the cutting tool does not exceed its permissible value. In this paper, to achieve this goal, the maximum feedrate map is calculated using a new method called the virtual displacement technique. This method can be used for one-step rough flat-end milling on a part that is defined by a spline equation. Using the resulting map for real-time path generation, the rough machining will be performed in the minimum amount of time while satisfying the force constraint.

LAMINAR FLOW MIXING ANALYSIS

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ABSTRACT

The objective of this work is to determine the mixing behavior of fluid in a laminar mixer. Turbulent flow is utilized in many cases, such as in liquid mixing and is positively responsive. However, it consumes a great amount of energy, especially for fluids with a large Schmidt number. It has been proven that mixing with Stokes flow can reduce this energy consumption rate. In this article, the effect of molecular diffusion has been neglected and a potential flow mixer has been introduced, which is cinematically similar to Stokes flow. Consequently, effective parameters have been realized and optimum amounts determined. This article demonstrates how the chaos theory can be applied for studying laminar mixing. By using the chaos theory, Poincare maps for different potential mixers have been represented. Analysis of these maps has revealed the dynamics of flow in the mixers and has determined the optimum values of parameters for efficient laminar mixing.