Crack propagation model taking into consideration the local effect of the deviatoric stress and the non-local effect of the isotropic stress

VRATISLAV KAFKA

Abstract. Ductile fracture initiated by a crack is modeled as a process influenced by two factors: (i) the local value of the elastic energy density of the deviatoric part of the stress tensor, and (ii) the nonlocal values of the elastic energy density of the isotropic part of the stress tensor. The effective spot for the deviatoric energy is located at some distance ahead of the crack tip, the nonlocal effect of the isotropic energy operates from a neighborhood of the effective spot, determined by a specific distance from this spot. These assumptions lead to a strength criterion, which is formally a generalization of the Mises criterion. The presented criterion can be used for modeling the influence of the length of the crack, for modeling such phenomena as avoidance of two cracks proceeding against each other, for the pop-in phenomenon, for slowing-down of the progress of a crack near a free surface, etc.

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Experimental and theoretical analysis of auto-parametric stability of pendulum with viscous dampers

Stanislav Pospíšil, Cyril Fischer, Jiří Náprstek

Abstract. An experimental analysis of a dynamic absorber on a tower represented by a spherical auto-parametric pendulum is carried out. Stability of the motion in a vertical plane of two pendulum configurations is analysed with regard to the semi-trivial solution. Three different types of the resonance domain are investigated. Their main properties depend significantly on dynamic parameters of the pendulum and of the external excitation amplitude. A special experimental frame is developed. It contains a pendulum supported by the Cardan joint and excited by a shaker. There are two magnetic units attached to the frame and to the supporting axes of rotation. They are able to reproduce linear viscous damping for both degrees of freedom. The stability of the system is analysed experimentally and compared with theoretical results. The analytical, numerical and experimental studies result in several recommendations for designers of these devices.

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Preliminary interferometry measurements of a flow field around fluttering NACA0015 profile

Václav Vlček, Jan Kozánek

Abstract. Experimental results of the optical measurements are presented of a flow field around the fluttering NACA0015 profile elastically supported as a two-degree freedom system in subsonic wind flow. A high-speed camera was used for the interferometry visualisation of the airflow in all phases of the profile's motion. Special care was devoted to a proper evaluation of the fringes near the surface of the profile, which was blurry due to the fast vibration. Interferograms, pressure, and flow velocity around the surface of the vibrating body and the phase shift between rotation and translation cycles are presented.

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Effect of exponential temperature variation on vibration of clamped visco-elastic rectangular plate whose thickness varies linearly in both directions

Arun K. Gupta, Harvinder Kaur

Abstract. The effect of exponential temperature variation on vibration of clamped visco-elastic rectangular plate whose thickness varies linearly in both directions is studied. Under the assumption that the plate is clamped along all the four edges and the temperature varies exponentially in one direction, Rayleigh–Ritz technique is used to determine the frequency equation. A two-term deflection function is assumed to be a solution. A small deflection and linear visco-elastic properties of Kelvin type are assumed. The time period and deflection at various points for different values of thermal gradients are calculated as well as the aspect ratio and taper constants, for the first two modes of vibration. Results are supported by graphs. Alloy Duralium is considered for all the material constants used in numerical calculations.

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SAMD—a program for mechatronic drive symbolic analyses

Jaroslav Kalous, Zdeněk Kolka, Dalibor Biolek

Abstract. An implementation of multi-domain symbolic analysis in a new program SAMD (Symbolic Analysis of Mechatronic Drives) is described and analyzed. The code is developed with the aim to analyze linear and linearized hybrid systems which combine classical electrical and electronic circuits, controllers, electro-mechanical converters and mechanical parts of mechatronic drives. The system to be analyzed can comprise both the single elements and more complex blocks. All submodels of individual components are stored and at disposal in an easily extensible program library. Implemented algorithms for symbolic simplification also allow analyzing larger systems.

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DTC of an induction motor drive

Jaroslava Žilková, Jaroslav Timko, Štefan Köver

Abstract. A method of direct torque control of a squirrel-cage induction motor is analyzed. The torque control of the squirrel-cage induction motor is implemented by means of the Takahashi direct torque control method, modified by the application of fuzzy logic. The paper describes the results achieved by the Takahashi DTC method and by DTC using fuzzy logic. Subsequently, simulation results achieved by both approaches are compared.

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Four-switch hybrid power filter working with six-fold switching symmetry

Jiří Klíma, Josef Tlustý,
Jiří Škramlík, Viktor Valouch

Abstract. An analytical model and original space-vector modulation strategy for a new circuit configuration of a hybrid power filter with only four switches and not utilizing the center point of the dc bus voltage is presented. An original closed-form solution of steady-state grid currents, based on the mixed p–z approach is introduced. The analytical results and experiment tests on the component minimized three-phase hybrid power filter are shown.

Contents

New Row-grouped CSR format for storing sparse matrices on GPU with implementation in CUDA

Tomáš Oberhuber, Atsushi Suzuki, Jan Vacata

Abstract. A new format for storing sparse matrices is suggested. It is designed to perform well mainly on GPU devices. Its implementation in CUDA is presented. Its performance is tested on 1600 different types of matrices. This format is compared in detail with a hybrid format, and strong and weak points of both formats are shown.

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