ABSTRACTS

Navid Moshtaghi Yazdani
Experimental Evaluation of the Effects of Structural Changes on the Vibration Properties of CK35 Steel

The microstructure of some components which operate in high-temperature conditions (e.g. boiler components, turbine blades used in gas power plants, jet engines and reactors) is subjected to changes in long run, which leads to a degradation in the mechanical properties of these components and consequently, reduces their lifecycle. Therefore, it is so useful to detect the changes in the microstructure of these parts during their operation, employing an easy, fast and non-destructive method to determine their remaining life. In this study, we evaluate the effects of the microstructural changes on natural frequencies and the damping coefficient of CK35 steel, employing the experimental modal test. We aim to use the method for power plant components, if it has significant effects. To do so, we applied spheroidization heat treatment on CK35 steel samples having a primary structure of ferrite-pearlite for 24 and 48 hours. Then, we carried out the experimental modal test on samples having different metallurgical structures, but with the same dimensions and weights. According to the findings, the spherical ferrite-carbide particles in the ferrite structure increase the natural frequencies and damping coefficient. These tests show that the structural changes in this type of steel result in slight changes in the values of natural frequencies; however, it significantly changes the damping frequencies.

Damak Hanen
The Practical Feedback Stabilization for Evolution Equations in Banach Spaces

This paper investigates the notion of practical feedback stabilization of evolution equations satisfying some relaxed conditions in infinite-dimensional Banach spaces. Moreover, sufficient conditions are presented that guarantee practical stabilizability of uncertain systems based on Lyapunov functions. These results are applied to partial differential equations.

Mohammad Javad Fotuhi, Zafer Bingul
Comparative Study of the Parallel and Angular Electrical Gripper for Industrial Applications

The aim of this paper is to study the position and power performances of an electrical lead screw-driven industrial gripper mechanism (LSDIGM). This work consists of designing and developing an electrical LSDIGM that has the potential to meet various demands in the automation industry and factories. The performances of both angular electrical gripper (AEG) and parallel electrical gripper (PEG) mechanisms were compared based on their position and power efficiency. The position efficiency of these electrical LSDIGM is computed from the position root mean square error (PRMSE) obtained from errors between the two measured positions (input incremental encoder and output linear encoder). In the experimental setup, a current sensor and a spring were employed to measure the current in the input of the system and the stiffness in the output of the system, respectively. The electrical power in the input of the electrical LSDIGM and the mechanical power in the output of the LSDIGMs were calculated using the current and the spring force, respectively. Finally, the power efficiency of these electrical LSDIGMs was examined and compared at different velocity circumstances.

Marcin Kalinowski, Zbigniew Kamiński
Measurement and Evaluation of Functional and Operational Coefficients of Hydraulic Solenoid Valve Prototypes Used for Variable Valve Timing Control in Combustion Engines

This paper describes the engineering structure and functions of a typical solenoid valve used in hydraulic mechanisms that are based on variable camshaft timing (VCT). The main operating parameters and functional utility coefficients of hydraulic solenoid valves have been defined. Tests of 10 reference and 10 prototype valves were run on a test stand for a comparative assessment of both engineering concepts based on Welch and Mann–Whitney statistical tests of the mean values of designated coefficients. The studies identified differences between both designs, and the obtained research material was used as an input to improve the performance of the engineered concept. To perform a final evaluation of the effects that arise as a result of changes introduced to some functional–operational coefficients, additional tests are required to be run on an engine testbed. The applied test methodology may then be used for control and verification tests of the valves, which can further be used in VCT technology.

Onur Şahin, Barış Erbaş, Brent Wilson
Approximate Formulation of the Rigid Body Motions of an Elastic Rectangle under Sliding Boundary Conditions

Low-frequency analysis of in-plane motion of an elastic rectangle subject to end loadings together with sliding boundary conditions is considered. A perturbation scheme is employed to analyze the dynamic response of the elastic rectangle revealing nonhomogeneous boundary-value problems for harmonic and biharmonic equations corresponding to leading and next order expansions, respectively. The solution of the biharmonic equation obtained by the separation of variables, a consequence of sliding boundary conditions, gives an asymptotic correction to the rigid body motion of the rectangle. The derived explicit approximate formulae are tested for different kinds of end loadings together with numerical examples demonstrating the comparison against the exact solutions.

Hoang Lan Ton-That
Plate Structural Analysis Based on a Double Interpolation Element with Arbitrary Meshing

This paper presents the plate structural analysis based on the finite element method (FEM) using a double interpolation element with arbitrary meshing. This element used in this research is related to the first-order shear deformation theory (FSDT) and the double interpolation procedure. The first stage of the procedure is the same with the standard FEM for the quadrilateral element, but the averaged nodal gradients must be computed for the second stage of this interpolation. Shape functions established by the double interpolation procedure exhibit more continuous nodal gradients and higher-order polynomial contrast compared to the standard FEM when analysing the same mesh. Note that the total degrees of freedom (DOFs) do not increase in this procedure, and the trial solution and its derivatives are continuous across inter-element boundaries. Besides, with controlling distortion factors, the interior nodes of a plate domain are derived from a set of regular nodes. Four practical examples with good results and small errors are considered in this study for showing excellent efficiency for this element. Last but not least, this element allows us to implement the procedure in an existing FEM computer code as well as can be used for nonlinear analysis in the near future.

Włodzimierz Balicki, Paweł Głowacki, Leszek Loroch
Birds Strike – Impact on the Safety of Civil Aircraft Operations in Poland in 2008- 2018

The authors assessed the real threat to civil aircraft traffic in Poland resulting from bird strikes. It was found that in the period 2013–2018, the probability of such events increased by four times. Data for this work were downloaded from the ECCAIRS database maintained by the Civil Aviation Authority. Air traffic events have been collected for several years in this database. An assessment of the energy of bird collision with the aircraft, resulting from the bird's mass and relative speed of movement, was also presented. Ways to minimise the risk of collision were described by introducing crew warning systems and means to scare off birds from the airport grounds. The method of testing the resistance of turbine engines to the foreign body's absorption was also shown, as well as design methods for increasing the engine resistance to bird strikes.