ABSTRACTS

Mohammed Said Achbi, Sihem Kechida, Lotfi Mhamdi, Hedi Dhouibi
A Neural-Fuzzy Approach for Fault Diagnosis of Hybrid Dynamical Systems: Demonstration on Three-Tank System

This work is part of the diagnostic field of hybrid dynamic systems (HDS) whose objective is to ensure proper operation of industrial facilities. The study is initially oriented to the modelling approach dedicated to hybrid dynamical systems (HDS). The objective is to look for an adequate model encompassing both aspects (continuous and event). Then, fault diagnosis technique is synthesised using artificial intelligence (AI) techniques. The idea is to introduce a hybrid version combining neural networks and fuzzy logic for residual generation and evaluation. The proposed approach is then validated on three tank system. The modelling and diagnosis approaches are developed using MATLAB/Simulink environment.

Volodimyr Kalchenko, Andrij Yeroshenko, Sergiy Boyko, Olga Kalchenko
Modeling of Contact Geometry of Tool and Workpiece in Grinding Process with Crossed Axes of the Tool and Workpiece with Circular Profile

A general model is developed, and on its basis, there are special models formulated of the grinding process with crossed axes of the tool and workpiece with a profile in the form of a circle arc. A new method of control of the grinding process is proposed, which will provide processing by equidistant curves, and the amount of cutting of a circle equal to the allowance. This will increase the productivity and quality of grinding. The presented method of grinding implements the processing with the spatial contact line of the tool and workpiece. When the axes are crossed, the contact line is stretched, which leads to an increase of the contact area and, accordingly, to a decrease of the temperature in the processing area. This allows processing of workpieces with more productive cutting conditions.

Mykhaylo Tkach, Yurii Halynkin, Arkadii Proskurin, Irina Zhuk , Volodymyr Kluchnyk, Igor Bobylev
An Experimental Study of the Vibrational Characteristics of a Diamond Circular Blade Using Electronic Speckle-Pattern Interferometry and FEM

The compact installation and technology for determining vibration characteristics by the ESPI method has been created. The experimental determination of the dynamic characteristics of a diamond circular blade with a diameter of 203.4 mm and a thickness of 1.19 mm using real-time electronic speckle interferometry is presented. 15 mode shapes of vibration were detected in the range from 100 to 5000 Hz. The program calculation of the natural frequencies and mode shapes is carried out for three values of the clamping inner diameter (42 mm, 44 mm, 46 mm). The options for calculating a disk with a rim and without a rim are considered. It is shown that the minimum mean squared error of the calculation is achieved for the values of the diameter of the disk 46 mm, 42mm and 44 mm for the number of nodal circles 0, 1 and 2, respectively. To verify the accuracy of the interferometer, experimental, computational and analytical studies of console steel rod 200 x 22.25 x 3.78 mm in size were carried out.

Mateusz Adamowicz, Leszek Ambroziak, Mirosław Kondratiuk
Efficient Non-Odometry Method for Environment Mapping and Localisation of Mobile Robots

The paper presents the simple algorithm of simultaneous localisation and mapping (SLAM) without odometry information. The proposed algorithm is based only on scanning laser range finder. The theoretical foundations of the proposed method are presented. The most important element of the work is the experimental research. The research underlying the paper encompasses several tests, which were carried out to build the environment map to be navigated by the mobile robot in conjunction with the trajectory planning algorithm and obstacle avoidance.

Askar Kudaibergenov, Askat Kudaibergenov, Danila Prikazchikov
Near-Resonant Regimes of a Moving Load on a Pre-Stressed Incompressible Elastic Half-Space

The article is concerned with the analysis of the problem for a concentrated line load moving at a constant speed along the surface of a pre-stressed, incompressible, isotropic elastic half-space, within the framework of the plane-strain assumption. The focus is on the near-critical regimes, when the speed of the load is close to that of the surface wave. Both steady-state and transient regimes are considered. Implementation of the hyperbolic–elliptic asymptotic formulation for the surface wave field allows explicit approximate solution for displacement components expressed in terms of the elementary functions, highlighting the resonant nature of the surface wave. Numerical illustrations of the solutions are presented for several material models.

Cezary Kownacki
Self-Adaptive Asymmetrical Artificial Potential Field Approach Dedicated to the Problem of Position Tracking by Nonholonomic UAVs in Windy Environments

Artificial potential fields (APFs) are a popular method of planning and controlling the path of robot movement, including unmanned aerial vehicles (UAVs). However, in the case of nonholonomic robots such as fixed-wing UAVs, the distribution of velocity vectors should be adapted to their limited manoeuvrability to ensure stable and precise position tracking. The previously proposed local asymmetrical potential field resolves this issue, but it is not effective in the case of windy environments, where the UAV is unable to maintain the desired position and drifts due to the wind drift effect. This is reflected in the growth of position error, which, similar to the steady-state error in the best case, is constant. To compensate for it, the asymmetrical potential field approach is modified by extending definitions of potential function gradient and velocity vector field (VVF) with elements based on the integral of position tracking error. In the case of wind drift, the value of this integral increases over time, and lengths and orientations of velocity vectors will also be changed. The work proves that redefining gradient and velocity vector as a function of position tracking error integrals allows for minimisation of the position tracking error caused by wind drift.

Borys Prydalnyi, Heorhiy Sulym
Identification of Analytical Dependencies of the Operational Characteristics of the Workpiece Clamping Mechanisms with the Rotary Movement of the Input Link

The research is devoted to the problem of determining the efficiency of the workpiece fixing mechanism operation. Improving characteristics of workpiece fixing is one of the required conditions to increase the cutting modes, which may help to enhance the machining productivity. The study investigates the main characteristics and general features of a new structure of clamping mechanisms with electromechanical actuators for fixation of rotation bodies. The main advantages of using electromechanical clamping actuators with self-braking gear are presented. Two simplified dynamical models for the description of different stages of the clamping process are developed. The calculation scheme was formulated to find out how the mass-geometric parameters of mechanism elements should influence the main characteristics of the clamping mechanisms of this type.