

Book Review

The Tracking Force and the Problems Arising

Computer Analysis of Electronic Models for Deformable Objects

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A new trend in simulation of deformable objects in building mechanics, civil engineering and applied theory of elasticity under dynamical excitations of vibrating type is presented in the book. Extensive calculations of different dynamic effects as well as of stability of various structural systems are described. Electronic models are synthesized and then analyzed with the help of software for electronic circuits using a personal computer. The author has proposed the method of active inverse once and twice doubling of unknowns for synthesis of electronic models. New non-standard equations were obtained by the author of the book. Chaotic vibrations in a number of systems under various types of excitations are determined and analyzed.

Effective forms of the method are developed for calculations of stability and for determination of eigenfrequencies and eigenmodes of structural elements having many degrees of freedom. The author has synthesized electronic models of rods working against longitudinal stresses as well as taking into account longitudinal – transverse bending. The method of simulation of free and forced oscillations of the continuous systems and of systems with concentrated masses is presented also. Two types of dynamic methods for the investigation of stability of the systems with a number of degrees of freedom have been proposed. The method of simulation of the shapes of deformations of the rod axis and of curves of bending moments in longitudinal and transverse bending was developed by the author. A number of types of tracking forces were analyzed. Investigations of perturbed motions of the rod under the action of tracking force for various parameters of the analyzed dynamical systems were performed. Minimum values of critical tracking forces were obtained. Analysis of parametric vibrations for a number of dynamical systems with different types of tracking forces was performed. Stability of the rod systems with initial imperfections of different types was investigated. Also stability of rod systems with non-linear character of action of the nodes of the rod was analyzed. A number of other related problems of calculation of stability and dynamics of conservative and non-conservative systems of rods were solved by the author. He proposed to determine the value of the compression force on the basis of the character of vibrations of the system. Also simultaneous solution of two problems is proposed: determination of the critical forces and of the eigenfrequencies of free vibrations, which is effective for non-conservative systems with tracking forces.

Electronic models of rods were obtained by taking geometric nonlinearity of the system into account. Geometrically changeable and unchangeable systems with rods and joints were investigated. The Mises frame was analyzed in detail and the conditions when it becomes a stochastic generator and when a strange attractor occurs were determined. The investigation of

chaotic vibrations taking place in systems of this type is performed in detail. Strange attractors for three types of forces are analyzed: for the force varying according to the harmonic sine law, for periodically repeating pulses, for the force having saw tooth type variation. Values of forces for which vibrations become chaotic were determined. Other more complicated chaotic motions with synchronous motions of supports are analyzed also. Simulation of systems of rods interacting with aggressive media is developed by the author. Model of the kinetic equation which describes the process of corrosion of material is proposed. Systems under the action of bending with distant large displacements were investigated. Character of deformation of the axis of the rod after the loss of stability was analyzed. Jump phenomenon was taken into account when analyzing the stability of curvilinear beams. A number of new problems are solved by the author and some of the previously known solutions have been improved. The developed approach of computer modeling opens new possibilities for the computer control of structures and systems.

Dr. V. Ovsianko is an author of more than 170 research papers and several research books. A number of devices created by him were presented in International exhibitions in various countries. He has several awards for his distinguished inventions and patents. He is a full member of the Ukrainian Academy of Construction and Editor in chief of the International journal "Construction".

This book is recommended for research workers, mechanical and civil engineers, physicists and others interested in the theory and calculations of dynamics and stability of structures in machine building and related areas.