

Book Review

Methods and Means of Nonlinear Vibrodiagnostics

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The research book is devoted to methods and means of technical vibrodiagnostics of machines and mechanisms on the basis of application of nonlinear mathematical models of the tested objects. New approaches of nonlinear vibrodiagnostics are presented. By using the methods of nonlinear theory of vibrations the authors obtained a number of effective and sensitive diagnostic methods. The use of nonlinear effects enables to increase the reliability of vibration control and simplifies diagnostics procedures. Main approaches and methodology of application of nonlinear effects in vibration diagnostics have been formulated by Professor S. Tsyfansky and developed by a number of Doctors supervised by him, including coauthors of this research book.

Research performed by the authors passes through the following stages: study of nonlinear effects by mathematical simulation of dynamics of the tested objects, experimental examination of possibility of practical application of nonlinear effects in a real engineering structure, thorough analysis of the novelty of all the discovered nonlinear phenomena, preparation of production prototypes and their practical application in industry. Authors present all the stages of investigation in the research book.

Local methods of vibrodiagnostics of damages in thin-walled structures are based on the method of added mass. Objects with dry friction and analysis of their possible failures are presented. Nonlinear electro-capacitance methods of nondestructive testing are investigated. Vibration analysis of viscosity of liquids and nonlinear vibration methods for flow measurement are proposed. Detection of cracks in flexible geometrically nonlinear beams and detection of cracks in rotor systems on the basis of vibrations are performed.

Examples of practical applications of the proposed diagnostic methods are presented such as detection of cracks in aviation structures and rotating shafts, nondestructive testing of technical condition of kinematic pairs with nonlinear elastic and dissipative characteristics, determination of moisture content in materials, etc. The authors of the book have a number of patents on the methods and means of diagnostics proposed by them. One is to note the cooperation of the leading Latvian scientists in this field with the scientists from the Russian Federation, Japan and countries of the European Union.

This book is based on the investigations performed by the acknowledged scientists. Professor Dr. Habil. Sc. Ing. S. Tsyfansky is head of the research laboratory of Nonlinear Phenomena of Vibrating Systems at Riga Technical University. He is a member of the New York Academy of Sciences and is an author of 10 research monographs and more than 350 scientific publications and patents. Dr. Sc. Ing. V. Beresnevich is a senior researcher of the same laboratory. He is also a member of the New York Academy of Sciences and is an author of 5 research monographs and more than 200 research papers and patents. Doctor of Technical Sciences B. Lushnikov is from South – West State University (Kursk, Russia). He is an author of 2 research monographs and more than 70 research papers and patents.

The book is recommended for scientists, researchers and engineers, which are involved in development and practical use of methods and devices for technical diagnostics of machines and mechanisms.