

Book Review

Non-Linear Resonances and Disasters. Reliability, Safety and Noiselessness

Book Author: R. Ganiev

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Reviewer: Professor Bronislovas Spruogis

Vilnius Gediminas Technical University, Vilnius, Lithuania

E-mail: *bronislovas.spruogis@vgtu.lt*

The book presents the fundamentals of non-linear oscillation processes in a number of mechanical systems. They are based on the assumption of multiple resonances, which generate intensive multidimensional motions. The book consists of two parts.

The first part of the book has five chapters, in which the scientific basis of non-linear multi-frequency vibrations is presented. The scientific basis is supported by the theoretical and experimental investigations. The investigations carried out are of a generalized model of a rigid body in the field of elastic forces as well as of the systems of rigid bodies that have rotating and vibrating parts. These parts include controlled auto-vibrating systems. The dynamics of helicopters and earth resonances are investigated. The common laws governing multi-dimensional vibrating processes are presented on the basis of the analysis of typical non-linear multi-frequency resonances.

These common laws are valid for other types of dynamic models, such as systems of rigid and rigid deformable bodies, including thin-walled shells with spaces filled with liquid and located in the flow of gas. They are investigated in the second part of the book, which consists of five other chapters. Non-linear resonance interactions of a rigid body with vibrations of the free surface of the fluid and with elastic vibrations are investigated. Non-linear multi-frequency resonance vibrations are especially important in cases of internal resonances that include the phenomena of flutter. Investigation results of the stabilization of vibrations and waves are presented. These results include the stability of fluid motion in structures, in pipes with various types of coatings with the purpose of reduction of hydrodynamic noise, resistance to the motion of bodies and hydraulic losses. Means of hydraulic impact avoidance are proposed.

Both the theoretical material and the obtained theoretical results confirmed by experimental investigations are presented in the book. Non-linear multi-frequency resonance vibrations are the main dangerous hidden source of noise in a number of structures. The obtained results indicate that multi-dimensional resonance oscillations create dangerous situations that often lead to destruction of a number of objects of contemporary technology. This is especially important in space devices, satellites, rockets, in the field of aviation in helicopters, planes, as well as in power engineering, transport, ship building and hydraulic engines. Recommendations and criteria for ensuring reliability, safety and noiselessness in engineering are presented.

R. Ganiev is the academician of the Russian Academy of Sciences, the director of the A. Blagonravov Mechanical Engineering Research Institute of the Russian Academy of Sciences, the head of the Scientific Center of Non-Linear Wave Mechanics and Technologies of the Russian Academy of Sciences. He is a leading scientist in the field of mechanics and machine building, in non-linear vibrations and wave processes, in dynamics of machines and devices.

The book is recommended for scientists, researchers and engineers working in the field of creation and development of contemporary engineering devices, in which vibrations and non-linear effects are of special importance.