MONOGRAPHS

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Nonlinear Dynamics of Machines

SUMMARY

Preface & Contents

Book Review

This monograph is oriented on the students of Mechanical Engineering as well as the Ph. D. students in the fields of "Mechanics" and "Machine Design and Exploitation".

Chapter 1 is devoted to modeling procedures used in mechanics. A special attention is paid to mathematical and physical models and classification of the models. The stability problems, with a special emphasis on the two Lyapunov methods and the Lyapunov functions, are described in chapter 2.
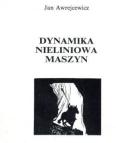
After a brief introduction some definitions of classical stability concepts are defined. Then three fundamental Lyapunov theorems on stability and one on unstability are described and illustrated. A pendulum stability is investigated. Then the stability criteria, including those of Routh, Hurwitz and Nyquist are discussed. Some introduced examples support the theoretical investigations.

Chapter 3 includes the phase plane method, the graphical-analytical techniques (isocline, the Jacobsen and the Liénard methods). Also the exact analytical approaches to analyse non-linear systems are briefly described. The perturbation (small parameter) the KBM (Krilov-Bogolubov-Mitropolskiy) and the equivalent linearization methods are discussed and illustrated.

In chapter 4 the nonlinear oscillations of lumped systems are analysed. First, the nonlinear dissipative non-autonomous one degree-of-freedom systems within and from resonances are considered as well as an introduction to analysis of a few degrees-of-freedom systems are carried out. A special attention is focused on a few important examples of self-excited systems with two degrees-of-freedom.

Chapter 5 is devoted to analysis of difference-differential equations with constant coefficients. The systems with small and large delay are analysed and investigation is focused on their periodical responses.

The last chapter is devoted to the general bifurcation theory. One- and two-dimensional bifurcations are analysed in detail and the numerical approaches for tracing regular solutions with a simultaneous observation of their stability and bifurcations are discussed and illustrated.