Frequency Methods in Oscillation Theory (Mathematics and Its Applications)

Gennady Leonov, I.M. Burkin, A.I. Shepeljavyi

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This book is devoted to nonlocal theory of nonlinear oscillations. The frequency methods of investigating problems of cycle existence in multidimensional analogues of Van der Pol equation, in dynamical systems with cylindrical phase space and dynamical systems satisfying Routh-Hurwitz generalized conditions are systematically presented here for the first time.
To solve these problems methods of Poincaré map construction, frequency methods, synthesis of Lyapunov direct methods and bifurcation theory elements are applied. V.M. Popov's method is employed for obtaining frequency criteria, which estimate period of oscillations. Also, an approach to investigate the stability of cycles based on the ideas of Zhukovsky, Borg, Hartmann, and Olech is presented, and the effects appearing when bounded trajectories are unstable are discussed. For chaotic oscillations theorems on localizations of attractors are given. The upper estimates of Hausdorff measure and dimension of attractors generalizing Doudy-Oesterle and Smith theorems are obtained, illustrated by the example of a Lorenz system and its different generalizations.
The analytical apparatus developed in the book is applied to the analysis of oscillation of various control systems, pendulum-like systems and those of synchronization.
Audience: This volume will be of interest to those whose work involves Fourier analysis, global analysis, and analysis on manifolds, as well as mathematics of physics and mechanics in general. A background in linear algebra and differential equations is assumed.

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