MONOGRAPHS

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Oscillations of Discrete Deterministic Systems

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SUMMARY

[Preface & Contents]

[Book Review]

This monograph is devoted to engineers and applied mathematicians interested in dynamical systems theory.
Chapter 1 includes fundamental concepts, classification of oscillating systems and formulation of equations of motion.
Chapter 2 introduces a reader into analysis of oscillations with an emphasis on graphical-analytical, exact and approximate analytical processes. Examples of real systems dynamics are given in Chapter 3. One, two and many degrees-of-freedom systems are discussed with a special attention paid to parametrical systems. Hill, Meissner and Mathieu second order ordinary differential equations are illustrated and their stability is discussed.
Chapter 4 focuses on self-excited and non-autonomous, non-linear systems. After a brief introduction, analysis of non-linear non-conservative non-autonomous systems is carried out. Both resonance and non-resonance cases are considered. The theoretical considerations are supported by examples. A special attention is paid to mechanical one and two degrees-of-freedom systems with Coulomb friction, where both qualitative and quantitative analysis are carried out.
The chaotic oscillations in deterministic systems are discussed in Chapter 5. This chapter includes Lorenz and Ueda attractors, Poincaré maps, Lyapunov exponents, fractal measure, power spectrum and autocorrelation function analysis. Also the routes to chaos are discussed and illustrated.
Chapter 6 introduces a reader to stability theory, where (contrary to the classical approach) also a detailed analysis of 3D systems is included. The general theory of linear systems, including that of periodic coefficients, is presented in Chapter 7.
Chapter 8 is addressed to numerical analysis of vibrations. Dynamical systems with both large and small time delay are presented in Chapter 9.
Finally, Chapter 10 is devoted to bifurcation analysis. It includes a brief introduction, and then the fundamental saddle-node, transcritical, pitchfork and Hopf bifurcations are discussed. considerations on the global numerical approaches end this chapter.