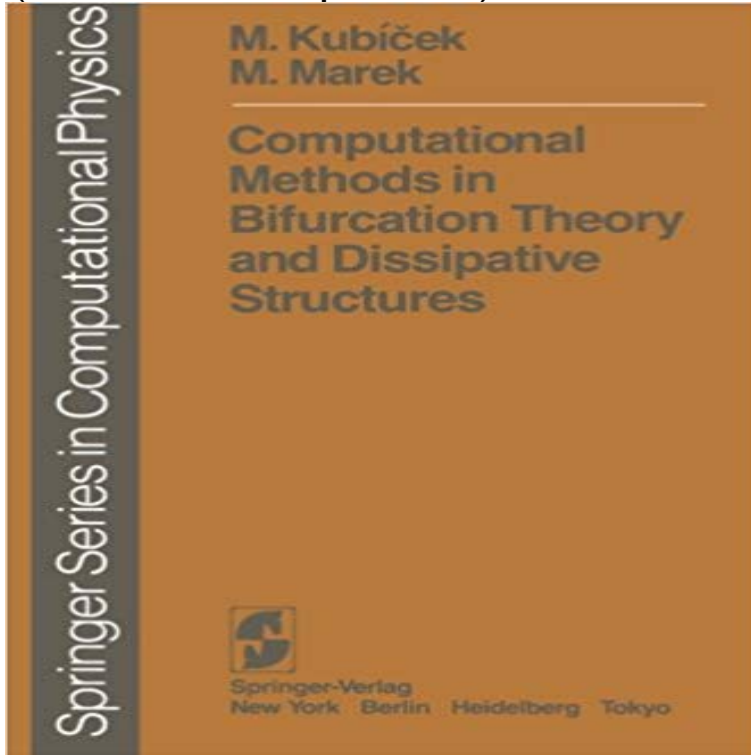


Computational Methods in Bifurcation Theory and Dissipative Structures (Scientific Computation)



Dissipative structures is a concept which has recently been used in physics to discuss the formation of structures organized in space and/or time at the expense of the energy flowing into the system from the outside. The space-time structural organization of biological systems starting from the subcellular level up to the level of ecological systems, coherent structures in laser and of elastic stability in mechanics, instability in hydro plasma physics, problems dynamics leading to the development of turbulence, behavior of electrical networks and chemical reactors form just a short list of problems treated in this framework. Mathematical models constructed to describe these systems are usually nonlinear, often formed by complicated systems of algebraic, ordinary differential, or partial differential equations and include a number of characteristic parameters. In problems of theoretical interest as well as engineering practice, we are concerned with the dependence of solutions on parameters and particularly with the values of parameters where qualitatively new types of solutions, e.g., oscillatory solutions, new stationary states, and chaotic attractors, appear (bifurcate). Numerical techniques to determine both bifurcation points and the dependence of steady-state and oscillatory solutions on parameters are developed and discussed in detail in this text. The text is intended to serve as a working manual not only for students and research workers who are interested in dissipative structures, but also for practicing engineers who deal with the problems of constructing models and solving complicated nonlinear systems.

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