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Book Reviews: *Dealing with Real-World Nonlinearities*

From Equilibrium to Chaos: Practical Bifurcation and Stability Analysis. Rudiger Seydel, Elsevier, New York, 1988.

Non-Linear Oscillations, 2nd ed. Peter Hagedorn, Clarendon Press, Oxford, 1988.

Nonlinear dynamics underlies many research areas which traditionally have been of interest to statistical physicists. Turbulence, for example, is one of several seemingly stochastic phenomena which can be explained, at least in part, by the temporal evolution of state variables associated with nonlinear mathematical models. For these reasons, two recently published volumes may be of interest. Both discuss methods for obtaining solutions to nonlinear differential equations, with special emphasis on scientific applications.

The first, *From Equilibrium to Chaos: Practical Bifurcation and Stability Analysis*, by Rudiger Seydel, emphasizes developments of the last two decades, particularly the use of numerical techniques. Modern terminology is used, and the book focuses on procedures for analyzing nonlinear behavior by describing significant features of the solution space (e.g., through graphical representation of branching behavior). Numerous examples from the physical and biological sciences are discussed, including topics pertaining to autocatalytic chemical reactions, zone-refining of semiconductors, Rayleigh–Bénard convection and other phenomena of fluid flow, nerve excitation, and models of myocardial infarction. This volume clearly indicates the profound changes in procedures and techniques for investigating the behavior of nonlinear systems which have been effected by modern digital computers. Practical methods for calculating branch points for systems of ordinary differential equations, and schemes for efficient determination of the stability behavior of boundary value problems, are discussed in considerable detail. However, analytical methods also are reviewed when appropriate. The book was developed from the author's teaching materials, and contains excellent introductory chapters on basic nonlinear behavior and a very nice concluding chapter covering contem-

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porary topics such as chaotic behavior. The bibliography contains over 350 references, and affords the interested reader a quick entry into the recent literature.

A good complement to the above volume is *Non-Linear Oscillations*, by Peter Hagedorn. This publication is a partially updated version of the author's 1977 book of the same title. It stresses analytical techniques for determining stability and solving various types of nonlinear differential equations which arise in descriptions of physical systems. Topics include Lyapunov stability theory, Hopf bifurcations, solutions of equations of various types (e.g., for free and forced oscillations in asymptotically stable systems, for self-excited oscillations), nonlinear Hamiltonian mechanics, and optimal control theory. The book derives from a one-semester course designed for graduate students in science and engineering, contains many problems with solutions, and is easy to learn from. Emphasis is on practical solutions of problems by classical analysis. This English edition (translated and edited by Wolfram Stadler) is clearly written and a pleasure to read.

Both books contain numerous excellent black and white diagrams which cogently illustrate points made in the text. Each would be a good addition to one's library.

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