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It's a nonlinear world.
Springer Undergraduate Texts in Mathematics and Technology. New York, NY: Springer (ISBN 978-0-387-75338-6/hbk; 978-0-387-75340-9/ebook). xii, 383 p. (2011).

The purpose of this very nice book is to introduce the reader to a "real world" illustrating exciting applications of ordinary differential equations (ODEs), partial differential equations (PDEs) and difference equations (DEs) or "maps" to a wide variety of phenomena surrounding us in everyday life. As it is clear from the title, the text emphasizes nonlinear dynamics in all its multi-facial appearances and presents efficient methods for analyzing nonlinear processes in natural and social sciences. There are two parts in the book, World of Mathematics and Our Nonlinear World. The first part consists of four chapters. After a brief introduction to mathematical models using ODEs and DEs and a concise discussion on numerical solution of nonlinear ODEs on the computer in Chapter 1, the author proceeds with a more detailed presentation of techniques used for the analysis of different classes of ODEs, DEs and PDEs in Chapters 2-4. In particular, Chapter 2 deals with fixed points and phase-plane analysis, bifurcations, limit cycles, strange attractors, fractal dimensions, Poincaré sections, chaos. Some of the topics considered in Chapter 3 are fixed points for one-dimensional maps, cobweb diagrams, period doubling road to chaos, Mandelbrot and Julia sets, control of chaos. Chapter 4 focuses on solitary wave solutions to some classes of PDEs. Soliton solutions to Korteweg-de Vries and sine-Gordon equations and similarity solutions are discussed here along with a brief overview of numerical methods for PDEs. All principal concepts and techniques presented in Part I are illustrated with a number of carefully selected examples. Numerous problems for self-study, references to relevant literature and internet resources are also suggested in each chapter. There are seven thematic chapters in the second part of the book with the titles directly indicating the principal topics covered therein: World of Motion, World of Sports, World of Electromagnetism, World of Weather Prediction, World of Chemistry, World of Disease and World of War. Each chapter contains a wide selection of worked out examples and problems for the independent study which require extensive use of methods and ideas introduced in the first part. Many interesting problems are considered here, the examples range from a "toy" model for Saturn's rings, to terminal velocity of falling badminton bird, to magnetic field lines for the Earth, to estimate of minimum speed for Black Death spread, to a model for the outbreak of war, to mention a few. The book is written in a precise and lively manner, it is well illustrated, the exposition is easy to follow. The text contains plenty of interesting information and realistic data; this turns every example or problem into a small and exciting research project. Taking into account a very wide spectrum of topics covered in the problems, one can use this text as a valuable source of information complementing a variety of standard college courses on ordinary and partial differential equations, mathematical modeling, applied and engineering mathematics. It can be also successfully used for teaching an independent course on nonlinear dynamics, for self-education and just as a pleasant recreational reading. Undoubtedly, this nice text serves as an excellent appetizer designed to foster the interest to mathematical modeling and nonlinear dynamics. Highly recommended reading for a very broad audience.

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