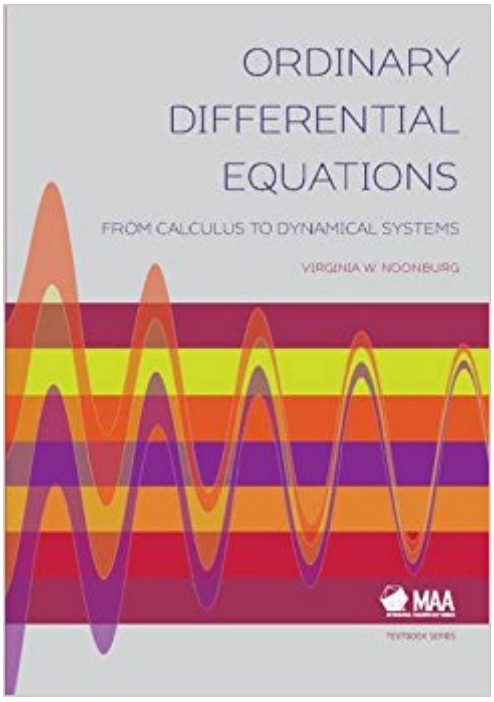
Ordinary Differential Equations: From Calculus To Dynamical Systems (Maa Textbooks)



Synopsis

This book presents a modern treatment of material traditionally covered in the sophomore-level course in ordinary differential equations. While this course is usually required for engineering students the material is attractive to students in any field of applied science, including those in the biological sciences. The standard analytic methods for solving first and second-order differential equations are covered in the first three chapters. Numerical and graphical methods are considered, side-by-side with the analytic methods, and are then used throughout the text. An early emphasis on the graphical treatment of autonomous first-order equations leads easily into a discussion of bifurcation of solutions with respect to parameters. The fourth chapter begins the study of linear systems of first-order equations and includes a section containing all of the material on matrix algebra needed in the remainder of the text. Building on the linear analysis, the fifth chapter brings the student to a level where two-dimensional nonlinear systems can be analyzed graphically via the phase plane. The study of bifurcations is extended to systems of equations, using several compelling examples, many of which are drawn from population biology. In this chapter the student is gently introduced to some of the more important results in the theory of dynamical systems. A student project, involving a problem recently appearing in the mathematical literature on dynamical systems, is included at the end of Chapter 5. A full treatment of the Laplace transform is given in Chapter 6, with several of the examples taken from the biological sciences. An appendix contains completely worked-out solutions to all of the odd-numbered exercises. The book is aimed at students with a good calculus background that want to learn more about how calculus is used to solve real problems in today's world. It can be used as a text for the introductory differential equations course, and is readable enough to be used even if the class is being "flipped." The book is also accessible as a self-study text for anyone who has completed two terms of calculus, including highly motivated high school students. Graduate students preparing to take courses in dynamical systems theory will also find this text useful.

Customer Reviews

Although Noonburg's book is slim, it covers (and covers well) all of the familiar topics one expects to find in a first semester sophomore-level ODE course, and then some. It also has some interesting features that distinguish it from most of the existing textbook literature, chief among them being a strong emphasis on the dynamical systems approach, which manifests itself in, for example, an early introduction to the idea of a system of differential equations, as well as an early introduction to the concept of the phase line and phase plane for autonomous first and second order ODEs. ... The

author's writing style is very clear and should be quite accessible to most students reading the book. There are lots of worked examples and interesting applications, including some fairly unusual ones. There are also numerous exercises, ranging in difficulty from the very routine (verify that such-and-such function is a solution to such-and-such differential equation) to more elaborate student projects, some of which are based on research papers. Some (carefully marked) exercises require computer assistance. Solutions to the odd-numbered problems appear in a 40 page appendix. ...

The essential tools for studying ordinary differential equations are given a modern treatment in this book, beginning with analytical methods, before progressing to graphical and numerical methods, bifurcation theory, higher-dimensional theory, and dynamical systems. Ideal for undergraduates in engineering and the applied sciences, particularly biology.

Systems (Textbooks in Mathematical Sciences) Differential Equations: Theory, Technique and Practice, Second Edition (Textbooks in Mathematics) Dynamical Systems: A Differential Geometric Approach to Symmetry and Reduction Numerical Partial Differential Equations: Conservation Laws and Elliptic Equations (Texts in Applied Mathematics) (v. 33)