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Abstract

This textbook is a detailed introduction to the theory of ordinary differential equations as well as a first approach to linear partial differential equations. In particular, known types of first-order ordinary differential equations are studied and their applications in physics, astronomy and economics are listed. Then linear differential equations of second and higher order as well as linear systems of differential equations are considered. Particular emphasis is placed on the variation of parameters method as a unified way of dealing with linear differential equations of any order and linear systems of equations. A separate chapter is devoted to the numerical solution of initial value problems in ordinary differential equations using basic and fundamental analytical methods such as the Euler method, its improved versions, as well as the Runge-Kutta method. The material of the book is supplemented by the solution method of power series at ordinary and singular points. Basic Laplace transforms are computed analytically and Fourier series are used in solving initial value problems. The reader is then introduced to the solution of boundary value problems and the basic classes of partial differential equations (especially the heat equation and the wave equation). Each paragraph contains a significant number of solved exercises and exercises to be solved. A number of specially labeled exercises is combined using software. Answers to selected unsolved exercises are listed in a separate appendix at the end of the book.

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