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Preface

Approach

This text is intended to provide a comprehensive treatment of the modeling techniques of the major types of engineering systems, the methods for solving the resulting differential equations, and the attendant mathematical procedures related to the representation of dynamic systems and the determination of their response characteristics.

The material is designed for a one-semester course in engineering at the undergraduate or graduate level. The reader is expected to have completed the basic lower division courses in chemistry, physics, mathematics, and engineering. The appendices supplement this background as necessary.

The introductory material on system dynamics gives a broad overview of the concepts of dynamic systems and the systems approach to the analysis and design of engineering systems. This should give the reader a feel for the similarity of the different engineering disciplines.

The modeling portions of the book begin with a discussion of the basic system components of each engineering discipline and then show how to combine these components into systems and how to obtain the appropriate governing differential equation models. Mechanical, electrical, fluid (hydraulic and pneumatic), and thermal systems are treated in detail, and emphasis is placed on the similarity of the response characteristics embodied in each of these physically dissimilar systems.

We stress the importance of matching the system mathematical model to the solution technique. Thus, classical differential equation models are recommended for