

## APPROACH

The formal boundaries of traditional engineering disciplines have become fuzzy following the advent of integrated circuits and computers. Nowhere is this more evident than in mechanical and electrical engineering, where products today include an assembly of interdependent electrical and mechanical components. The field of mechatronics has broadened the scope of the traditional field of electromechanics. *Mechatronics* is defined as the field of study involving the analysis, design, synthesis, and selection of systems that combine electronic and mechanical components with modern controls and microprocessors.

This book is designed to serve as a text for (1) a modern instrumentation and measurements course, (2) a hybrid electrical and mechanical engineering course replacing traditional circuits and instrumentation courses, (3) a stand-alone mechatronics course, or (4) the first course in a mechatronics sequence. The second option, the hybrid course, provides an opportunity to reduce the number of credit hours in a typical mechanical engineering curriculum. Options 3 and 4 could involve the development of new interdisciplinary courses.

Currently, many curricula do not include a mechatronics course but include some of the elements in other, more traditional courses. The purpose of a course in mechatronics is to provide a focused interdisciplinary experience for undergraduates that encompasses important elements from traditional courses as well as contemporary developments in electronics and computer control. These elements include measurement theory, electronic circuits, computer interfacing, sensors, actuators, and the design, analysis, and synthesis of mechatronic systems. This interdisciplinary approach is valuable to students because virtually every newly designed engineering product is a mechatronic system.

## CONTENT

Chapter 1 introduces mechatronic and measurement system terminology. Chapter 2 provides a review of basic electrical relations, circuit elements, and circuit analysis. Chapter 3 deals with semiconductor electronics. Chapter 4 presents approaches to analyzing and characterizing the response of mechatronic and measurement systems. Chapter 5 covers the basics of analog signal processing and the design and analysis of operational amplifier circuits. Chapter 6 presents the basics of digital devices and the use of integrated circuits. Chapter 7 provides an introduction to microcontroller programming and interfacing, and specifically covers the PIC microcontroller and PicBasic Pro programming. Chapter 8 deals with data acquisition and how to couple computers to measurement systems. Chapter 9 provides an overview of the many

sensors common in mechatronic systems. Chapter 10 introduces a number of devices used for actuating mechatronic systems. Finally, Chapter 11 provides an overview of mechatronic system control architectures and presents some case studies. The appendices review the fundamentals of unit systems, statistics, error analysis, and mechanics of materials to support and supplement measurement systems topics in the book. One mechatronics topic this book does not cover is control theory. This topic is important and should be included in a curriculum that emphasizes mechatronics, but we decided it would be impractical to adequately cover the topic in this book.

## **LEARNING TOOLS**

Class discussion items are included throughout the book to serve as thought-provoking exercises for the students and instructor-led cooperative learning activities in the classroom. They can also be used as out-of-class homework assignments to supplement the questions and exercises at the end of each chapter. Analysis and design examples are also provided throughout the book to improve a student's ability to apply the material. To enhance student learning, carefully designed laboratory exercises coordinated with the lectures should accompany a course using this text. The combination of class discussion items, design examples, and laboratory exercises exposes a student to a real-world practical approach and provides a useful framework for future design work.

## **SUPPLEMENTS**

More information, including a recommended course outline, a typical laboratory syllabus, MathCAD files for examples from the book, Class Discussion Item hints, links to mechatronics resources, and other supplemental material, is available on the author's Internet site at

[www.engr.colostate.edu/~dga/mechatronics.html](http://www.engr.colostate.edu/~dga/mechatronics.html)

These resources, and a complete, password-protected Instructor's Guide containing solutions to all end-of-chapter problems, are also available at the McGraw-Hill Book Website at:

[www.mhhe.com/engcs/mech/alciatore/](http://www.mhhe.com/engcs/mech/alciatore/)

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