Preface

The purpose of the third edition remains the same as the first and second editions, that is, to serve as an introduction to and overview of the field of biomedical engineering. Many chapters have undergone major revision from the previous editions with new end-of-chapter problems added. Some chapters were eliminated completely, with several new chapters added to reflect changes in the field.

Over the past fifty years, as the discipline of biomedical engineering has evolved, it has become clear that it is a diverse, seemingly all-encompassing field that includes such areas as bioelectric phenomena, bioinformatics, biomaterials, biomechanics, bioinstrumentation, biosensors, biosignal processing, biotechnology, computational biology and complexity, genomics, medical imaging, optics and lasers, radiation imaging, tissue engineering, and moral and ethical issues. Although it is not possible to cover all of the biomedical engineering domains in this textbook, we have made an effort to focus on most of the major fields of activity in which biomedical engineers are engaged.

The text is written primarily for engineering students who have completed differential equations and a basic course in statics. Students in their sophomore year or junior year should be adequately prepared for this textbook. Students in the biological sciences, including those in the fields of medicine and nursing can also read and understand this material if they have the appropriate mathematical background.

Although we do attempt to be fairly rigorous with our discussions and proofs, our ultimate aim is to help students grasp the nature of biomedical engineering. Therefore, we have compromised when necessary and have occasionally used less rigorous mathematics in order to be more understandable. A liberal use of illustrative examples amplifies concepts and develops problem-solving skills. Throughout the text, MATLAB® (a matrix equation solver) and SIMULINK® (an extension to MATLAB® for simulating dynamic systems) are used as computer tools to assist with problem solving. The Appendix provides the necessary background to use MATLAB® and SIMULINK®. MATLAB® and SIMULINK® are available from:

The Mathworks, Inc.
24 Prime Park Way
Natick, Massachusetts 01760
Phone: (508) 647-7000
Email: info@mathworks.com
WWW: http://www.mathworks.com

Chapters are written to provide some historical perspective of the major developments in a specific biomedical engineering domain as well as the fundamental principles that underlie biomedical engineering design, analysis, and modeling procedures in that domain. In addition, examples of some of the problems encountered, as well as the techniques used to solve them, are provided. Selected problems, ranging from simple to difficult, are presented at the end of each chapter in the same general order as covered in the text.

The material in this textbook has been designed for a one-semester, two-semester, or three-quarter sequence depending on the needs and interests of the instructor. Chapter 1 provides necessary background to understand the history and appreciate the field of biomedical engineering. Chapter 2 presents the vitally important chapter on biomedically based morals and ethics. Basic anatomy and physiology are provided in Chapter 3. Chapters 4–11 provide the basic core biomedical engineering areas: biomechanics, biomaterials, tissue engineering, compartmental modeling, biochemical reactions, bioinstrumentation, biosensors, and biosignal processing. To assist instructors in planning the sequence of material they may wish to emphasize, it is suggested that the chapters on bioinstrumentation, biosensors and biosignal processing should be covered together as they are interdependent on each other. The remainder of the textbook presents material on biomedical systems and biomedical technology (Chapters 12–17).

Readers of the text can visit http://www.elsevierdirect.com/9780123749796 to view extra material that may be posted there from time to time.

Instructors can register at http://www.textbooks.elsevier.com for access to solutions and additional resources to accompany the text.

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