such as cardiovascular disease, gastroenterology, general and thoracic surgery, gynecology, neurosurgery, and oncology are introduced.

Although this book does not include some of the most recent developments (such as the CO_2 lasers used for wrinkle removal or transventricular myocardial revascularization), it does provide the biomedical engineer or medical technologist with a most useful and comprehensive introduction to the theory and practice of lasers and optical fibers for medical applications.

—Yixiong Xu
The Presbyterian Hospital in the City of New York

Mathematics and Physics of Emerging Biomedical Imaging

Report of the National Research Council, 1996, National Academy Press, Washington, DC. ISBN: 0-309-05387-0, 240 pages.

Mathematics and Physics of Emerging Biomedical Imaging is a survey of current methods in bioimaging. It is available in paperback form and on the World Wide Web (http://www.nas.edu). The text provides an overview of the history and methods for each bioimaging topic covered. The topics include x-ray projection imaging, x-ray computed tomography, magnetic resonance imaging, emission tomography, ultrasonics, electrical and magnetic source imaging, and impedance tomography. There are a few color plates at the end of the first chapter and a few diagrams scattered throughout, but the book is mostly textual.

The text is best used by an expert in the field who wants to review certain topics in bioimaging. Several chapters are only a few pages long. It would be difficult to understand as an introductory text because the coverage of each subject is not extensive. Some terms are introduced that would seem to require a thorough treatment, but explanations are either not given or they are relegated to footnote status. There are few equations in the bioimaging-related chapters themselves. Most of the imaging equations are lumped in a separate chapter titled "A Cross-Cutting Look at the Mathematics of Emerging Biomedical Imaging." However, these rather complex equations are not described in great detail. There are, however, copious suggested readings at the end of each chapter.

The World Wide Web page is fairly simple to use. After going to http://www.nas.edu, click on: "Publications and reports," "On-Line books," "Title index," "M," and then the book title. The full contents of the report is available for download. Chapter 1 (Introduction and Summary) is screen formatted. The other chapters are in LaTeX format and the LaTeX formatting appears on the screen.

—Edward J. Ciaccio, Ph.D.
Columbia University

The Electrical Engineering Handbook

Richard C. Dorf (Editor-in-Chief), 1993, CRC press, Boca Raton, FL, xxvii + 2661 pages, ISBN 0-8493-0185-8.

Electrical engineering is a broad discipline with many diverse subfields. Electrical engineers can be found in professions ranging from medicine to aeronautics and from semiconductor physics to computer networking. Constructing a useful reference text for this ocean of scientists is a challenge indeed. Richard C. Dorf, as editor-in-chief, has compiled *The Electrical Engineering Handbook* as an answer to this challenge. Dr. Dorf is a professor of electrical and computer engineering at the University of California, Davis. Other publications by Dr. Dorf include *Modern Control Systems, The International Encyclopedia of Robotics,* and *Circuits, Devices and Systems.*

This 6.5 lb. (courtesy U.S. Postal Service), 2661-page, hardbound desk reference for the electrical engineer has 109 chapters that are divided among 12 major sections. Section titles include: Circuits, Electronics, Computer Engineering, and Biomedical Systems, among others. Each chapter is further divided into 10- to 20-page subsections that have been written by a variety of authors. The list of contributing authors is impressive: six pages of mostly American academicians with a sprinkling of private-sector researchers and some authors from China, England, Canada, and France as well.

The basics of electrical circuits and electronic components are among the first sections. The last section is a collection of relevant constants, equations, units and physical principles that is surely worth its weight in gold. This section also lists information about no less than 19 associations and societies related to electrical engineering. Finally, the book is thoroughly referenced by subject, author, and equation with additional indices of key figures and tables. The table of contents is clearly organized as well.

I examined the Biomedical Systems section closely due to its relevance to biomedical engineering and this publication. It included seven chapters: Bioelectricity, Biomedical Sensors, Bioelectronics and Instruments, Medical Imaging, Rehabilitation Engineering, Biocomputing, Safety and Risk-Control Issues. These chapters were written by very well known researchers in biomedical engineering and other fields.

The Bioelectricity chapter covers the origins of the electroencephalograph (EEG) the electrocardiograph (ECG), and the electromyogram (EMG), and an excellent bone and soft-tissue repair using electric and magnetic fields. The Bioelectronics chapter also covers EEGs and EKGs, but much more thoroughly, including the history, relevant anatomy, and government regulations regarding equipment design of each.

The Biomedical Sensors chapter includes an explanation of physical and chemical sensors and a short section on enzyme-substrate mediated sensors. There was nothing mentioned about "smart-sensors," and the section on applications of biomedical sensors was a little sparse. It covers the basics of blood pressure and blood chemistry analysis, but leaves out many applications such as indicator dilution studies that utilize various types of sensors, i.e., thermal, optical, ultrasonic properties of blood.

The Medical Imaging chapter includes sections on magnetic resonance imaging, computerized tomography, positron emission tomography, and single photonemission tomography under the general heading of Tomography. These sections are unfortunately very brief, but they effectively communicate the basics of each imaging modality. In the end the reader is referred to four more elaborate texts if further information is required.

Oddly, the section on ultrasound occupies as many pages as all of the previous imaging topics combined. It includes a hefty page on the fundamentals of acoustics as well as descriptions of both A- and B-mode ultrasound imaging. There is no mention of plane-film radiography, the most ubiquitous diagnostic imaging device, or laser Doppler imaging, one of the newest and most innovative medical imaging techniques, in the imaging chapter.

There was a wealth of acronyms as well as information in the Biomedical Computing chapter. This chapter was divided into two subsections: Clinical Information Systems and Hospital Information Systems. The many unfamiliar abbreviations and acronyms made this section very difficult to comprehend in one or even more readings. This unavoidable problem was not ignored by the author who included a list of definitions at the end. The large reference section is a comforting reminder that this

chapter is potentially informative about one of the hottest fields in medical computing.

The Rehabilitation Engineering chapter is interesting reading. It covers engineering accomplishments in overcoming sensory, communication, and motor disabilities in humans. Also included is an elegant example of rehabilitation engineering: the cochlear implant. Finally the Safety and Risk-Control Issues chapter is informative about the inherent risks involved in human-machine interactions that are so prevalent in biomedical engineering. Most interesting are the examples of potentially dangerous situations and how to avoid them, and a list of standards and regulations publications.

The end of each chapter includes references and definitions of terms as well as a "Further Information" section that points the reader to more verbose publications on the topics of interest. In spite of the incredible weight, this is a good book. The biomedical engineer that wants a good desk reference of electrical engineering would do well to purchase it. Any other person that wants information about biomedical engineering will find *that The Electrical Engineering Handbook* is a good launching pad.

—Kevin Seale
Vanderbilt University

Editor's Note: Richard Dorf was a classmate of mine almost 50 years ago at Creston Jr. High School in the Bronx. I often have wondered what has become of those many bright young lads. I am happy to hear of the accomplishments of one of them.

—A.W.