Book Reviews

Paul King

Design of Pulse Oximeters

J.G. Webster (Editor), Institute of Physics Publishing, Bristol and Philadelphia, 1997, ISBN: 0-7503-0467-7, 244 pages, $99.

Noninvasive monitoring of arterial oxygen saturation by means of pulse oximeters (PO) is currently a routine procedure in a wide variety of medical disciplines. In the USA alone, clinicians use scores of different PO models. The effectiveness of PO medical applications requires from both users and biomedical engineers an extremely high level of understanding of such diverse fields of knowledge as physiology, PO principles and design, and algorithms for the calculation of blood oxygen saturation. As one who has been involved in field of biomedical optics and engineering for more than 15 years, I can say that this book is a complete guide to understanding, using, and designing the PO. It is difficult to overestimate the value of this book for biomedical engineers and for all those who needs to know the technical workings of this instrument.

Design of Pulse Oximeters provides complete coverage of the field—from basic principles (chapters 2-4) and techniques (chapters 5-8) to signal-processing algorithms and calibration (chapters 9-10). Supplemented with an abundance of figures, tables, and equations, the book is easy to read and clear in understanding. Well edited, it leaves the impression that it was written by one author, which is a rarity among multi-authored texts. There is no doubt that Design of Pulse Oximeters will be a valued source on pulse oximetry. It will be particularly useful for graduate students, biomedical technicians, and instrument designers as the essential reference that encompasses the entire field of pulse oximetry.

Unfortunately, the theoretical chapters (4 and 9) are slightly weaker than the others. Spending a few pages to describe Beer's law, the authors then say almost nothing about the role of the scattering processes and the current state of research in this area. They bypass the diffusion theory of blood particles (A. Ishimary, "Wave propagation and Scattering in Random Media," Academic Press, New York, 1978) and modern experimental results. There is nothing in these chapters about optical properties of tissues under compression that contain blood, which is very important for the understanding of motion artifact. This interference (noise) is a significant concern in the real-world use of pulse oximeters for patient monitoring. As a previous study has shown, the optomechanical effects of blood circulation can be used, in principle, to mitigate motion artifact (V. Grimblatov, "Optomechanical Effect of Tissue Blood Circulation Under Compression," Proc. SPIE, Vol. 3253, 1997). I believe that a wider theoretical description of the photoplethysmographic aspects of pulse oximetry would make the book more useful for scientists as well as instrument developers.

Of course, this note does not affect the obvious advantages of the book. To my knowledge, this is the best book to date dedicated to pulse oximetry. It will remain an important reference for many years to come.

—Valentin Grimblatov, Ph.D.
Department of Biomedical Engineering
Columbia-Presbyterian Medical Center

Shielding Techniques for Radiation Oncology Facilities

Patton H. McGinley, 1998. Medical Physics Publishing, Madison, WI. ISBN: 0-944838-81-2 (hardcover), 0-944838-82-0 (softcover). x + 147 pages. $62.95 Hardcover.

This short book is a valuable introduction and reference for any biomedical engineer engaged in shielding from the effects of radiation. The book starts with a condensed but informative history of radiation protection. Shield and maze design are then described for both conventional and high-energy facilities. Metal and concrete shields are discussed in detail in a separate chapter. There is also a separate brief chapter on photoneutrons from high energy (greater than 10 Mev) electron accelerators. Some special topics also included are radiation skyshine, HVAC considerations, air activation, ozone, and some alternate shielding materials. Simulator, HDR, and brachytherapy rooms are considered separately.

This book brings updates shielding for modern radiation sources and techniques. It is a practical book that is based on examples rather than excessive theoretical aspects of radiation. Problems and an extensive reference list make this book suitable for a senior- or graduate-level course in medical or health physics.

—Yixiong Xu
Department of Biomedical Engineering
Columbia-Presbyterian Medical Center