BOOKS AND PUBLICATIONS

All interested medical physicists are encouraged to have their names added to a list of available reviewers. Please rank your interest among radiation therapy, x-ray, imaging, nuclear medicine imaging, ultrasound imaging, MR imaging, radiation injury, radiation protection, and others. Make your interest known to Dimitris Mihailidis, Ph.D., Books Review Editor (dimitris@charlestonradiation.com). Include your name and e-mail address in the body of the response.

Computed Tomography From Photon Statistics to Modern Cone-Beam CT. Thorsten M. Buzug. Springer-Verlag, Berlin-Heidelberg, Germany, 2008. 522 pp. (hardcover). Price: $109.00. ISBN: 9783540394075.

Description

This is a modern monograph on computed tomography (CT) that covers the most recent advances in CT technology, image analysis, and reconstruction methods. It is a well-structured, information rich, and highly technical text. According to the author, this is the second edition (in English) of a text written in German that was published in 2004 under the title *Einführung in die Computertomographie*.

Purpose

The author has succeeded in bringing together the mathematical details of signal processing and image reconstruction with a comprehensive and practical overview of modern CT technology.

Audience

This book is not for beginners. It can serve as a supplementary text of reference for graduate students and researchers in medical physics, electrical engineering, and biomedical engineering who specialize in general signal processing and image analysis. It requires knowledge of advanced mathematics such as Fourier, Hilbert, and Hankel transforms and elements of signal theory, to mention a few, that are traditionally taught to graduate level physicists and engineers. Medical residents in radiology and radiologists might not directly benefit from such a text.

Content/Features

The content of this text is impressive. It is laid out in 11 chapters. Each chapter includes a large number of good quality colored figures. There are a total of 475 figures and 10 data tables within the text. I find that the book can be divided in three major sections.

Section 1: The first three chapters cover the historical development of CT, the fundamental principles of x-ray physics, and the major milestones in CT technologies. The level of complexity of these three chapters is not as demanding of advanced mathematical knowledge as the rest of the text. This would allow one to use the first section (Chaps. 1–3) to supplement a more traditional text for a graduate course in CT physics and technology.

Section 2: Chapters 4–8 cover in detail the mathematical formalism and mathematical approaches in signal processing, 2D and 3D reconstruction methods, and their technical implementations. I find that the formalism presented in this part of the text can also assist researchers and experts in nuclear medicine image analysis and reconstruction such as SPECT and PET. A few highlights covered here are fan-beam geometry, cone-beam geometry, and spiral CT.

Section 3: Chapters 9–11 cover image quality and artifacts, practical aspects of CT and applications, and finally, CT dose and dose reduction. All chapters are supported by an extended bibliography provided at the end of the text.

One last comment on Chaps. 4–11 is that the author has made a special effort to provide the derivations of the equations that construct the algorithms described in the text.

Assessment/Comparison

This is definitely an advanced monograph in CT technology and image reconstruction that will better serve readers with a strong mathematical background. It can also serve as a specialized manual or reference for researchers and experts in the field of medical physics and biomedical engineering.

Reviewed by Dimitris Mihailidis, Ph.D.

Dimitris Mihailidis, Ph.D. is the Chief Medical Physicist at Charleston Radiation Therapy Consultants, PLLC, in Charleston, West Virginia and the current Department Editor for Books and Publications of the journal Medical Physics. He has been practicing clinical radiation oncology physics for several years and provides consultation services in medical diagnostic imaging and nuclear medicine physics to various medical institutions. He is board certified by the ABMP and ABR in radiation oncology physics.

Physics for the Life Sciences. Martin Zinke-AllmangNelson Education Ltd., Toronto, ON, Canada, 2009. 741 pp. (hardcover). $143 CND, ISBN: 9780176442590.

Description

This textbook addresses the clinical and biological aspects of physics at the introductory level. For this, the author started with a clean sheet design with the specific needs of the health sciences student in mind.

Purpose

This book addresses an area of physics that was in need of attention at the introductory level, a text specifically targeting the clinical and biological aspects of physics. Considering a potential market consisting of first and second year university students majoring in the health sciences and having a physics requirement to fulfill, the book is a necessary one at the right time.

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Audience

The text is primarily targeted at first or second year undergraduate students who will go on to major in health related disciplines and will be required to take introductory physics. The author does a reasonably good job of addressing the needs of such students.

Content/Features

In Part 1 (Chaps. 1–5) the book covers a brief introduction to Newtonian mechanics from a physiological perspective. Part 2 (Chaps. 6–9) introduces energy conservation, the gas laws, and physical biochemistry. Part 3 (Chaps. 10–15) deals with hydrostatics and fluid dynamics, as applied to blood flow and electric currents. Part 4 (Chaps. 16–20) deals with the physics of hearing and vision, and finally, Part 5 (Chaps. 21–23) introduces the concepts of space and radiation medicine.

I have class tested Part 4 of the text in a second year course on the physics of hearing and vision. Chapter 16 is an interesting introduction to the phenomena of elastic behavior followed by the establishment of the conditions necessary for simple harmonic motion from a physiological perspective. Axial bone compression under stress and modeling the leg as a physical pendulum in the act of walking are two relevant physiological examples that the author exploits quite aptly. Chapter 17 is an introduction to acoustics as applied to the human auditory organ, and this reviewer especially appreciated the lengthy discussion of the Darwinian advantages of the amplifying properties of the middle ear. Chapter 18 is an introduction to geometric optics comparable in level to what would be found in other standard introductory physics texts (minus the calculus), followed by an interesting discussion of the most frequent ophthalmic pathologies. In particular, the physical aspects of hyperopia (farsightedness) are well presented, with more abbreviated discussions of astigmatism, cataracts, and glaucoma, also thrown in for completeness. Chapter 19 is a short chapter on microscopy, in which the author deals effectively with the fundamentals of optical microscopy. In Chap. 20, the author introduces the concept of color vision, touching among other things on the "psychological vs physical" debate on the nature of color. A brief introduction to electromagnetic theory and an interesting discussion on the physical interactions of solar radiation with the atmosphere are contained as well.

The publisher and author provide additional supporting materials one might expect in a product of this type, such as a printed student solutions manual, an instructor's solutions manual in CD format, and Power Point slides to accompany the lectures. This reviewer found that the slides were frequently very useful for lecturing; however, they do contain their share of typographical errors.

The text does have weaknesses, perhaps the most substantial one being that in his attempt to present a unified view of medical/biological physics, the author omits any serious introduction to the crucial subjects of radiotherapy, nuclear medicine, and/or diagnostic radiological physics. By adding a chapter (or chapters) addressing these subjects in a future edition, the market footprint of this text could be significantly enhanced.

Assessment/Comparison

The physics in this text is certainly mathematically "lighter" than the standard introductory texts such as Serway and Beichner's "Physics for Scientists and Engineers," in that Zinke-Allmang chose a noncalculus (i.e., algebra-geometry-trigonometry) platform for his book. However, the book addresses an area of physics that was in need of some attention at the introductory level: A text specifically targeting the clinical and biological aspects of physics. This is a substantial market that so far has been largely ignored by authors and publishers; at a minimum it includes the subset of all students in North American universities who will go on to major in health related disciplines and be required to take introductory physics. Some partial attempts have been made to acknowledge this target audience, and one that comes to mind is James S. Walker's "Physics," now in its fourth edition. However, almost invariably these are texts that at their core were aimed primarily at physical science and engineering students, with occasional clinical references or problems sprinkled at the end of the chapters. Zinke-Allmang, on the other hand, started with a clean sheet design with the health sciences student in mind and in addressing his/her needs, I believe he has achieved a measure of success.

My overall impression is that this text represents a breath of fresh air in the somewhat stuffy introductory physics market in that the author is targeting a subset of the student population that other authors have either treated as an afterthought or not at all. This reviewer is unaware of any other text in the North American market that specifically addresses this special target audience. Professor Zinke-Allmang is to be commended for successfully taking on this difficult challenge.

Reviewed by Eduardo Galiano, Ph.D.

Eduardo Galiano, Ph.D. is Associate Professor in the Department of Physics at Laurentian University in Sudbury, ON, Canada. He is an academic medical physicist with research interests in radiotherapy and nuclear medicine physics.