

## **Computed Tomography Principles Design Artifacts And Recent Advances Second Edition Spie Press Monograph Vol Pm188**

This open access book gives a complete and comprehensive introduction to the fields of medical imaging systems, as designed for a broad range of applications. The authors of the book first explain the foundations of system theory and image processing, before highlighting several modalities in a dedicated chapter. The initial focus is on modalities that are closely related to traditional camera systems such as endoscopy and microscopy. This is followed by more complex image formation processes: magnetic resonance imaging, X-ray projection imaging, computed tomography, X-ray phase-contrast imaging, nuclear imaging, ultrasound, and optical coherence tomography.

"2021 marks the 50th anniversary of the x-ray computed tomography (CT). Over the years, CT has experienced tremendous technological development, driven mainly by clinical needs but also by technology advancements in other fields. Six years after the third edition of Computed Tomography, this fourth edition captures the most recent advances in technology and clinical applications. New to this edition are descriptions of artificial intelligence, machine learning, and deep learning, and their application to image reconstruction, protocol optimization, and workflow. A new chapter is added to describe the principles and advances in dual-energy and spectral CT. New detector technology, the photon counting detector, is described in details and its impact on CT system and clinical applications is analyzed. Many exciting development in clinical applications, such as cardiac functional imaging and stroke management, are also covered in details"--

Spectral, Photon Counting Computed Tomography is a comprehensive cover of the latest developments in the most prevalent imaging modality (x-ray computed tomography (CT)) in its latest incarnation: Spectral, Dual-Energy, and Photon Counting CT. Disadvantages of the conventional single-energy technique used by CT technology are that different materials cannot be distinguished and that the noise is larger. To address these problems, a novel spectral CT concept has been proposed. Spectral Dual-Energy CT (DE-CT) acquires two sets of spectral data, and Spectral Photon Counting CT (PC-CT) detects energy of x-ray photons to reveal additional material information of objects by using novel energy-sensitive, photon-counting detectors. The K-edge imaging may be a gateway for functional or molecular CT. The book covers detectors and electronics, image reconstruction methods, image quality assessments, a simulation tool, nanoparticle contrast agents, and clinical applications for spectral CT.

The first of its kind, this series is devoted to the use of physical principles in the study and scientific conservation of objects with cultural heritage significance. It begins with a review of the modern museum, which discusses new techniques employed in the conservation of museum artifacts such as X-ray tomography and

other techniques used to study Egyptian mummies, bones and mineralization of bones in the archaeological context, and the degradation of parchment. All of these topics and techniques are essential for the preservation of our history. This includes finding ways to preserve parchment documents and letters, which much of our written heritage is documented on, so that it can be used and understood for generations to come. This book is a must have for any museum as well as any university that teaches or employs the techniques discussed. Written in a style that is readily understandable by conservation scientists, archaeologists, museum curators, and students Provides an introduction to the advanced fields of synchrotron radiation science, neutron science, and computed tomography Outstanding review of the use of modern technology to study museum and archaeological artifacts Offers solutions through advanced scientific techniques to a wide range of problems facing museum staff

This volume provides an overview of X-ray technology and the historical development of modern CT systems. The main focus of the book is a detailed derivation of reconstruction algorithms in 2D and modern 3D cone-beam systems. A thorough analysis of CT artifacts and a discussion of practical issues such as dose considerations give further insight into current CT systems. Although written mainly for graduate students, practitioners will also benefit from this book.

At last, here is a comprehensive compilation of the accumulated knowledge on PET and PET/CT in oncology. It covers the entire spectrum from solidly documented indications, such as staging and monitoring of lung and colorectal cancer, to the application of PET/CT in head and neck surgery, gynecology, radiation therapy, urology, pediatrics and others. The chapters are supplemented by an introduction into the underlying techniques of both imaging devices and radiopharmacy.

Positron Emission Tomography is a nuclear medicine technique first used to study the brain. Several decades ago, PET scanners design and performance have improved considerably: number of detectors has increased from 20 to 20,000, axial field of view from 2 to 20 cm, spatial resolution has improved from 25 to 5 mm, sensitivity has increased of about 1000 fold. At the same time, clinical applications have grown dramatically. In the first section of this book the authors review some of developments in PET instrumentation, with emphasis on data acquisition, processing and image formation. In the second section authors expose examples of applications in human research. In the last section authors describe applications in assessment and prediction of oncological treatment response.

Now fully updated, the second edition of Modern Diagnostic X-Ray Sources: Technology, Manufacturing, Reliability gives an up-to-date summary of X-ray source technology and design for applications in modern diagnostic medical imaging. It lays a sound groundwork for education and advanced training in the physics of X-ray production, X-ray interactions with matter, and imaging

modalities and assesses their prospects. The book begins with a comprehensive and easy-to-read historical overview of X-ray tube and generator development, including key achievements leading up to the current technological and economic state of the field. The book covers the physics of X-ray generation, including the process of constructing X-ray source devices. The stand-alone chapters can be read in order or in selections. They take you inside diagnostic X-ray tubes, illustrating their design, functions, metrics for validation, and interfaces. The detailed descriptions enable objective comparison and benchmarking. This detailed presentation of X-ray tube creation and functions enables you to understand how to optimize tube efficiency, particularly with consideration for economics and environmental care. It also simplifies faultfinding. Along with covering the past and current state of the field, the book assesses the future regarding developing new X-ray sources that can enhance performance and yield greater benefits to the scientific community and to the public. After heading international R&D, marketing and advanced development for X-ray sources with Philips, and working in the X-ray industry for more than four decades, Rolf Behling retired in 2020 and is now the owner of the consulting firm XtraininX, Germany. He holds numerous patents and is continuously publishing, consulting and training.

Computed tomography (CT) is a widely used x-ray scanning technique. In its prominent use as a medical imaging device, CT serves as a workhorse in many clinical settings throughout the world. It provides answers to urgent diagnostic tasks such as oncology tumor staging, acute stroke analysis, or radiation therapy planning. Spectral Computed Tomography provides a concise, practical coverage of this important medical tool. The first chapter considers the main clinical motivations for spectral CT applications. In Chapter 2, the measurement properties of spectral CT systems are described. Chapter 3 provides an overview of the current state of research on spectral CT algorithms. Based on this overview, the technical realization of spectral CT systems is evaluated in Chapter 4. Device approaches such as DSCT, kV switching, and energy-resolving detectors are compared. Finally, Chapter 5 summarizes various algorithms for spectral CT reconstructions and spectral CT image postprocessing, and links these algorithms to clinical use cases

Virtual Reconstruction serves as an introduction to the principles of three-dimensional visualization techniques as they relate to fossil reconstruction and reverse engineering. It covers data acquisition, processing, virtual reconstruction, visualization, manipulation, reverse engineering, and applications to biomedicine. An adjunct Web site provides access to software, as well as sample data sets and relevant Internet links.

This publication is aimed at students and teachers involved in programmes that train medical physicists for work in diagnostic radiology. It provides, in the form of a syllabus, a comprehensive overview of the basic medical physics knowledge required for the practice of modern diagnostic radiology. This makes it particularly

useful for graduate students and residents in medical physics programmes. The material presented in the publication has been endorsed by the major international organisations and is the foundation for academic and clinical courses in both diagnostic radiology physics and in emerging areas such as imaging in radiotherapy.

While books on the medical applications of x-ray imaging exist, there is not one currently available that focuses on industrial applications. Full of color images that show clear spectrometry and rich with applications, X-Ray Imaging fills the need for a comprehensive work on modern industrial x-ray imaging. It reviews the fundamental science of x-ray imaging and addresses equipment and system configuration. Useful to a broad range of radiation imaging practitioners, the book looks at the rapid development and deployment of digital x-ray imaging system. This book is intended to serve as an invaluable reference for anyone concerned with the application of wavelets to signal processing. It has evolved from material used to teach "wavelet signal processing" courses in electrical engineering departments at Massachusetts Institute of Technology and Tel Aviv University, as well as applied mathematics departments at the Courant Institute of New York University and École Polytechnique in Paris. Provides a broad perspective on the principles and applications of transient signal processing with wavelets Emphasizes intuitive understanding, while providing the mathematical foundations and description of fast algorithms Numerous examples of real applications to noise removal, deconvolution, audio and image compression, singularity and edge detection, multifractal analysis, and time-varying frequency measurements Algorithms and numerical examples are implemented in Wavelab, which is a Matlab toolbox freely available over the Internet Content is accessible on several level of complexity, depending on the individual reader's needs New to the Second Edition Optical flow calculation and video compression algorithms Image models with bounded variation functions Bayes and Minimax theories for signal estimation 200 pages rewritten and most illustrations redrawn More problems and topics for a graduate course in wavelet signal processing, in engineering and applied mathematics

X-ray computed tomography (CT) has experienced an explosion of technological development for a quarter century. Six years after the second edition of Computed Tomography, this third edition captures the most recent advances in technology and clinical applications. New to this edition are descriptions of iterative reconstruction, statistical reconstruction, methodologies used to model the CT systems, and the searching methodologies for optimal solutions. A new section on 3D printing introduces approaches by early adopters in the area. Also added is a description and discussion of the size-specific dose estimate, an index that attempts to more accurately reflect the dose absorption of specific-sized patients. The coverage of dual-energy CT has been significantly expanded to include its background, theoretical development, and clinical applications. Machine learning represents a paradigm shift in tomographic imaging, and image

reconstruction is a new frontier of machine learning. This book will meet the needs of those who want to catch the wave of smart imaging. The book targets graduate students and researchers in the imaging community. Open network software, working datasets, and multimedia will be included. The first of its kind in the emerging field of deep reconstruction and deep imaging, Machine Learning for Tomographic Imaging presents the most essential elements, latest progresses and an in-depth perspective on this important topic.

Computed Tomography Principles, Design, Artifacts, and Recent Advances SPIE-International Society for Optical Engineering

"MDCT: From Protocols to Practice" tackles contemporary and topical issues in MDCT technology and applications. As an updated edition of MDCT: A Practical Approach, this volume offers new content as well as revised chapters from the previous volume. New chapters discuss important topics such as imaging of children and obese subjects, the use of contrast medium in pregnant women, coronary MDCT angiography, and PET/CT in abdominal and pelvic malignancies. Furthermore an Appendix with over 50 updated MDCT scanning protocols completes this publication. The book emphasizes the practical aspects of MDCT, making it an invaluable source of information for radiologists, residents, medical physicists, and radiology technologists in everyday clinical practice.

This practical and highly illustrated guide is an essential resource for veterinarians seeking to improve their understanding and use of computed tomography (CT) in practice. It provides a thorough grounding in CT technology, describing the underlying physical principles as well as the different types of scanners. The book also includes principles of CT examination such as guidance on positioning and how to achieve a good image quality. Written by specialists from twelve countries, this book offers a broad range of expertise in veterinary computed tomography, and is the first book to describe the technology, methodology, interpretation principles and CT features of different diseases for most species treated in veterinary practice. Key features

- An essential guide for veterinarians using CT in practice
- Includes basic principles of CT as well as guidelines on how to carry out an effective examination
- Describes CT features of different diseases for most species treated in practice
- Written by a range of international leaders in the field
- Illustrated with high quality photographs and diagrams throughout

In recent years, cone beam computed tomography (CBCT) has become much more widely available and utilised in all aspects of dentistry, including endodontics. Cone Beam Computed Tomography in Endodontics is designed to inform readers about the appropriate use of CBCT in endodontics, and enhance their clinical practice with this exciting imaging modality.

Leveraging the organization and focus on exam preparation found in the comprehensive text, this Exam Review will help any student to successfully complete the ARRT General Radiography and Computed Tomography exams. The book includes a bulleted format review of content, Registry-style questions with answers and rationales, and a mock exam following the ARRT format. The companion website offers an online testing simulation engine.

At the heart of every medical imaging technology is a sophisticated mathematical model

of the measurement process and an algorithm to reconstruct an image from the measured data. This book provides a firm foundation in the mathematical tools used to model the measurements and derive the reconstruction algorithms used in most of these modalities. The text uses X-ray computed tomography (X-ray CT) as a 'pedagogical machine' to illustrate important ideas and its extensive discussion of background material makes the more advanced mathematical topics accessible to people with a less formal mathematical education. This new edition contains a chapter on magnetic resonance imaging (MRI), a revised section on the relationship between the continuum and discrete Fourier transforms, an improved description of the gridding method, and new sections on both Grangreat's formula and noise analysis in MR-imaging. Mathematical concepts are illuminated with over 200 illustrations and numerous exercises.

This is the first monograph to focus exclusively on coronary radiology. It is particularly timely, given that the emergence of computed tomography and magnetic resonance imaging, coupled with improvements in both hard- and software, has made reproducible non-invasive coronary imaging a practical reality. A wide range of topics is addressed, including: quantitative angiography, intravascular and quantitative ultrasound, multislice and electron beam computed tomography, magnetic resonance coronary angiography and use of the coronary calcium score as an independent risk factor. All of the latest developments, such as non-invasive intracoronary thrombus imaging, are covered. Particular care has been taken to consider the common questions confronted in asymptomatic patients. The text is supported by high-quality color images of the coronary and cardiac anatomy.

Conventional computed tomography (CT) techniques employ a narrow array of x-ray detectors and a fan-shaped x-ray beam to rotate around the patient to produce images of thin sections of the patient. Large sections of the body are covered by moving the patient into the rotating x-ray detector and x-ray source gantry. Cone beam CT is an alternative technique using a large area detector and cone-shaped x-ray beam to produce 3D images of a thick section of the body with one full angle (360 degree or 180 degree plus detector coverage) rotation. It finds applications in situations where bulky, conventional CT systems would interfere with clinical procedures or cannot be integrated with the primary treatments or imaging systems. Cone Beam Computed Tomography explores the past, present, and future state of medical x-ray imaging while explaining how cone beam CT, with its superior spatial resolution and compact configuration, is used in clinical applications and animal research. The book: Supplies a detailed introduction to cone beam CT, covering basic principles and applications as well as advanced techniques Explores state-of-the-art research and future developments while examining the fundamental limitations of the technology Addresses issues related to implementation and system characteristics, including image quality, artifacts, radiation dose, and perception Reviews the historical development of medical x-ray imaging, from conventional CT techniques to volumetric 3D imaging Discusses the major components of cone beam CT: image acquisition, reconstruction, processing, and display A reference work for scientists, engineers, students, and imaging professionals, Cone Beam Computed Tomography provides a solid understanding of the theory and implementation of this revolutionary technology.

A comprehensive, tutorial-style introduction to the algorithms necessary for

tomographic imaging.

This book focuses on applications of micro CT, CBCT and CT in medicine and engineering, comprehensively explaining the basic principles of these techniques in detail, and describing their increasing use in the imaging field. It particularly highlights the scanning procedure, which represents the most crucial step in micro CT, and discusses in detail the reconstruction process and the artifacts related to the scanning processes, as well as the imaging software used in analysis. Written by international experts, the book illustrates the application of micro CT in different areas, such as dentistry, medicine, tissue engineering, aerospace engineering, geology, material engineering, civil engineering and additive manufacturing. Covering different areas of application, the book is of interest not only to specialists in the respective fields, but also to broader audience of professionals working in the fields of imaging and analysis, as well as to students of the different disciplines.

I am very pleased to have been asked to write the foreword to this book. The technical advances in diagnostic radiology in the last few decades have transformed clinical practice and have been nothing short of astonishing. The subject of diagnostic radiology is now very large and radiology departments are involved in all areas of modern patient care. The defining event in modern radiology, and arguably the most significant development in radiology since Wilhelm Röntgen discovered X-rays, was the invention of the CT scanner in the 1970s. The CT scanner introduced modern cross-sectional imaging and also digital imaging. We now have MRI and ultrasound and these techniques are replacing many traditional X-ray procedures. The developments in radiology have been the result of a fruitful interaction between the basic sciences, clinical medicine and the manufacturers. This can be seen by looking at the various sources of these publications. Change is produced by the interactions between the various disciplines. The editors have had a very difficult task in selecting the key discoveries and descriptions. The radiological literature is very large. Medical imaging continues to develop rapidly and these papers are the foundations of our current practice.

Since its introduction to dentistry, cone beam computed tomography (CBCT) has undergone a rapid evolution and considerable integration into orthodontics. However, despite the increasing popularity of CBCT and progress in applying it to clinical orthodontics, the profession has lacked a cohesive, comprehensive and objective reference that provides clinicians with the background needed to utilize this technology optimally for treating their patients. Cone Beam Computed Tomography in Orthodontics provides timely, impartial, and state-of-the-art information on the indications and protocols for CBCT imaging in orthodontics, clinical insights gained from these images, and innovations driven by these insights. As such, it is the most current and authoritative textbook on CBCT in orthodontics. Additionally, two DVDs include more than 15 hours of video presentations on related subjects from the 39th Annual Moyers Symposium

and 38th Annual International Conference on Craniofacial Research. Cone Beam Computed Tomography in Orthodontics is organized to progress sequentially through specific topics so as to build the knowledge base logically in this important and rapidly evolving field. Part I provides the foundational information on CBCT technology, including radiation exposure and risks, and future evolutions in computed tomography. Part II presents the Principles and Protocols for CBCT Imaging in Orthodontics, focusing on developing evidence-based criteria for CBCT imaging, the medico-legal implications of CBCT to the professional and the protocols and integration of this technology in orthodontic practice. Part III provides critical information on CBCT-based Diagnosis and Treatment Planning that includes how to interpret CBCT scans, identify incidental pathologies and the possible other uses of this technology. Part IV covers practical aspects of CBCT's Clinical Applications and Treatment Outcomes that encompasses a range of topics, including root morphology and position, treatment of impacted teeth, virtual surgical treatment planning and outcomes, and more.

"Medical Image Reconstruction: A Conceptual Tutorial" introduces the classical and modern image reconstruction technologies, such as two-dimensional (2D) parallel-beam and fan-beam imaging, three-dimensional (3D) parallel ray, parallel plane, and cone-beam imaging. This book presents both analytical and iterative methods of these technologies and their applications in X-ray CT (computed tomography), SPECT (single photon emission computed tomography), PET (positron emission tomography), and MRI (magnetic resonance imaging).

Contemporary research results in exact region-of-interest (ROI) reconstruction with truncated projections, Katsevich's cone-beam filtered backprojection algorithm, and reconstruction with highly undersampled data with  $l_0$ -minimization are also included. This book is written for engineers and researchers in the field of biomedical engineering specializing in medical imaging and image processing with image reconstruction. Gengsheng Lawrence Zeng is an expert in the development of medical image reconstruction algorithms and is a professor at the Department of Radiology, University of Utah, Salt Lake City, Utah, USA.

This issue of Radiologic Clinics of North America focuses on Multi-Energy CT: The New Frontier in Imaging, and is edited by Drs. Savvas Nicolaou and Mohammed F. Mohammed. Articles will include: Dual Energy CT: Image Acquisition, Processing and Workflow; Dual Energy CT: Dose Reduction, Contrast Load Reduction and Series Reduction in DECT; Dual Energy CT in Cardiothoracic Vascular Imaging; Advanced Musculoskeletal Applications with Dual Energy CT; Dual Energy CT of the Acute Abdomen; The Role of Dual Energy CT in Assessment of Abdominal Oncology; Future Developments in Dual Energy CT; Strategies to Improve Image Quality on DECT; Pearls, pitfalls and problems in DECT imaging of the body; Dual Energy CT – Technology and Challenges; The Role of Dual Energy CT in Thoracic Oncology; and more!

Advances in Paleoimaging: Applications for Paleoanthropology, Bioarchaeology, Forensics, and Cultural Artifacts builds on the research and advances in



technology since the writing of the authors' first book, *Paleoimaging: Field Applications for Cultural Remains and Artifacts* (ISBN: 978-1-4200-9071-0). Since *Paleoimaging* was published in 2009, additional research settings for the application of advanced imaging technologies have been identified. Practices are now more widespread and standardized with the capabilities and utilization of imaging methodologies increasing dramatically. Given the numerous advances in paleoimaging technique and technology, this book chronicles the evolution that has taken place in all the imaging modalities. Chapters include the coverage of magnetic resonance imaging, computed tomography, plane and digital radiography, endoscopy, and applications of x-ray fluorescence, as well as the principles of industrial radiography. While the book focuses on a multimodal imaging approach to anthropological and archaeological research, the authors and contributing authors have vast experience in other areas and present coverage of biological applications as well. The multidisciplinary chapters provide a foundation to understand the application of various imaging modalities in archaeological, anthropological, bioanthropological, and forensic settings. As such, *Advances in Paleoimaging* will serve as an essential reference for conservators, museum archivists, forensic anthropologists, paleopathologists, and archaeologists, who perform non-destructive research on historical or culturally significant artifacts, remains, or material from a forensic investigation. The concepts and methods presented in this text are supported with case presentations of the authors' vast experience in the new companion book, *Case Studies for Advances in Paleoimaging* (ISBN: 978-0-367-25166-6) by Beckett, Conlogue, and Nelson (2020).

Takes technical process of CT scanning and breaks it down to digestible components. Provides technical detail essential to understanding the modality. X-ray computed tomography (CT) continues to experience rapid growth, both in basic technology and new clinical applications. Seven years after its first edition, *Computed Tomography: Principles, Design, Artifacts, and Recent Advancements, Second Edition*, provides an overview of the evolution of CT, the mathematical and physical aspects of the technology, and the fundamentals of image reconstruction algorithms. Image display is examined from traditional methods used through the most recent advancements. Key performance indices, theories behind the measurement methodologies, and different measurement phantoms in image quality are discussed. The CT scanner is broken down into components to provide the reader with an understanding of their function, their latest advances, and their impact on the CT system. General descriptions and different categories of artifacts, their causes, and their corrections are considered at length. Given the high visibility and public awareness of the impact of x-ray radiation, the second edition features a new chapter on x-ray dose and presents different dose reduction techniques ranging from patient handling, optimal data acquisition, image reconstruction, and post-process. Based on the advancements over the past five years, the second edition added new sections on cone beam

reconstruction algorithms, nonconventional helical acquisition and reconstruction, new reconstruction approaches, and dual-energy CT. Finally, new to this edition is a set of problems for each chapter, providing opportunities to enhance reader comprehension and practice the application of covered material.

This cross-disciplinary book documents the key research challenges in the mathematical sciences and physics that could enable the economical development of novel biomedical imaging devices. It is hoped that the infusion of new insights from mathematical scientists and physicists will accelerate progress in imaging. Incorporating input from dozens of biomedical researchers who described what they perceived as key open problems of imaging that are amenable to attack by mathematical scientists and physicists, this book introduces the frontiers of biomedical imaging, especially the imaging of dynamic physiological functions, to the educated nonspecialist. Ten imaging modalities are covered, from the well-established (e.g., CAT scanning, MRI) to the more speculative (e.g., electrical and magnetic source imaging). For each modality, mathematics and physics research challenges are identified and a short list of suggested reading offered. Two additional chapters offer visions of the next generation of surgical and interventional techniques and of image processing. A final chapter provides an overview of mathematical issues that cut across the various modalities.

The book offers a comprehensive and user-oriented description of the theoretical and technical system fundamentals of computed tomography (CT) for a wide readership, from conventional single-slice acquisitions to volume acquisition with multi-slice and cone-beam spiral CT. It covers in detail all characteristic parameters relevant for image quality and all performance features significant for clinical application. Readers will thus be informed how to use a CT system to an optimum depending on the different diagnostic requirements. This includes a detailed discussion about the dose required and about dose measurements as well as how to reduce dose in CT. All considerations pay special attention to spiral CT and to new developments towards advanced multi-slice and cone-beam CT. For the third edition most of the contents have been updated and latest topics like dual source CT, dual energy CT, flat detector CT and interventional CT have been added. The enclosed CD-ROM again offers copies of all figures in the book and attractive case studies, including many examples from the most recent 64-slice acquisitions, and interactive exercises for image viewing and manipulation. This book is intended for all those who work daily, regularly or even only occasionally with CT: physicians, radiographers, engineers, technicians and physicists. A glossary describes all the important technical terms in alphabetical order. The enclosed DVD again offers attractive case studies, including many examples from the most recent 64-slice acquisitions, and interactive exercises for image viewing and manipulation. This book is intended for all those who work daily, regularly or even only occasionally with CT: physicians, radiographers, engineers, technicians and physicists. A glossary describes all the important technical terms in alphabetical order.

X-ray computed tomography has been used for several decades as a tool for measuring the three-dimensional geometry of the internal organs in medicine. However, in recent years, we have seen a move in manufacturing industries for the use of X-ray computed tomography; first to give qualitative information about the internal geometry and defects in a component, and more recently, as a fully-quantitative technique for dimensional and materials analysis. This trend is primarily due to the ability of X-ray computed tomography to give a high-density and multi-scale representation of both the external and internal geometry of a component, in a non-destructive, non-contact and relatively fast way. But, due to the complexity of X-ray computed tomography, there are remaining metrological issues to solve and the specification standards are still under development. This book will act as a one-stop-shop resource for students and users of X-ray computed tomography in both academia and industry. It presents the

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fundamental principles of the technique, detailed descriptions of the various components (hardware and software), current developments in calibration and performance verification and a wealth of example applications. The book will also highlight where there is still work to do, in the perspective that X-ray computed tomography will be an essential part of Industry 4.0. Whole body computed tomography has developed at a rapid pace in the past decade, spurred on by the introduction of spiral and multislice scanning. These new technologies have not only improved diagnostic accuracy, but also made new applications possible that were previously accessible only through more complex or invasive techniques. This new book expertly fills a gap in the literature by combining the practically relevant technical background with the clinical information required for correctly performing and interpreting CT examinations. The book presents the state-of-the-art capabilities and requirements of CT as a key diagnostic and interventional tool, with special emphasis on the role of spiral and multi-slice CT. You will find a thorough introduction to CT technology from scanner design to 3D image reconstruction, useful practical hints on how to optimize your examination protocols and how to keep the radiation exposure of your patients to a minimum, as well as an extensive clinical section in which symptoms, pathology and CT morphology are integrated to provide you with the basis for subtle interpretation of CT findings using the most modern CT techniques. Highlights include:- Full coverage of single-slice, 4-slice and 16-slice scanning techniques- Introduction to extended CT applications including cardiac CT, CT fluoroscopy, and 3D image processing- Organ-specific protocols for scanning and contrast administration- Practical guidelines for maximizing image quality and minimizing radiation exposure- Useful suggestions for image interpretation and for avoiding pitfalls and errors- Convenient format by organ system and disease entity- Full discussion of organ-specific pathology and CT morphology- CT indications integrated with other imaging modalities At a time when CT examinations are becoming more technically demanding and complex, with an increasing number of scan parameters and advances in 3D reconstructions, this book is an essential professional tool. Experienced practitioners will find their diagnostic and technical skills improved by reading the book, and beginners will enjoy the clear, systematic approach that will help them use the technique with confidence.

This book is specifically designed to meet the needs of practicing radiologists by offering a practical, unified approach to PET-CT. It details how to effectively apply PET-CT in patient management. Written by radiologists who fully appreciate and understand both PET and CT, the book details an integrated understanding of PET-CT as a combined modality. Clinical topics include PET-CT of thoracic malignancies, melanoma, and breast cancer. In addition, the book reinforces fundamental concepts, such as the role of imaging diagnosis in disease management.

Magnetic Resonance Imaging (MRI) is among the most important medical imaging techniques available today. There is an installed base of approximately 15,000 MRI scanners worldwide. Each of these scanners is capable of running many different "pulse sequences", which are governed by physics and engineering principles, and implemented by software programs that control the MRI hardware. To utilize an MRI scanner to the fullest extent, a conceptual understanding of its pulse sequences is crucial. Handbook of MRI Pulse Sequences offers a complete guide that can help the scientists, engineers, clinicians, and technologists in the field of MRI understand and better employ their scanner. Explains pulse sequences, their components, and the associated image reconstruction methods commonly used in MRI Provides self-contained sections for individual techniques Can be used as a quick reference guide or as a resource for deeper study Includes both non-mathematical and mathematical descriptions Contains numerous figures, tables, references, and worked example problems Build the foundation necessary for the practice of CT scanning with Computed Tomography: Physical Principles, Clinical Applications, and Quality Control, 4th Edition. Written to meet the varied requirements of radiography students and practitioners, this two-color text provides

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comprehensive coverage of the physical principles of CT and its clinical applications. Its clear, straightforward approach is designed to improve your understanding of sectional anatomic images as they relate to CT — and facilitate communication between CT technologists and other medical personnel. Comprehensively covers CT at just the right depth for technologists — going beyond superficial treatment to accommodate all the major advances in CT. One complete CT resource covers what you need to know! The latest information on advances in CT imaging, including: advances in volume CT scanning; CT fluoroscopy; multi-slice applications like 3-D imaging, CT angiography, and virtual reality imaging (endoscopy) — all with excellent coverage of state-of-the-art principles, instrumentation, clinical applications, and quality control. More than 600 photos and line drawings help students understand and visualize concepts. Chapter outlines show you what is most important in every chapter. Strong ancillary package on Evolve facilitates instructor preparation and provides a full complement of support for teaching and learning with the text NEW! Highlights recent technical developments in CT, such as: the iterative reconstruction; detector updates; x-ray tube innovations; radiation dose optimization; hardware and software developments; and the introduction of a new scanner from Toshiba. NEW! Learning Objectives and Key Terms at the beginning of every chapter and a Glossary at the end of the book help you organize and focus on key information. NEW! End-of-Chapter Questions provide opportunity for review and greater challenge. NEW! An added second color aids in helping you read and retain pertinent information

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