

COMPUTED TOMOGRAPHY Physical Principles, Clinical Applications, and Quality Control FOURTH EDITION

by Dr. Euclid Seeram · Language: EN

Summary by booksummaryai.com — <https://booksummaryai.com/country/en/computed-tomography-physical-principles-clinical-applications-and-quality-control-fourth-edition>

Overview

This book is a definitive resource on computed tomography (CT), covering its fundamental physical principles, diverse clinical applications, and essential quality control procedures. It systematically guides readers through the evolution of CT technology, from basic X-ray physics and image formation to advanced multi-slice and dual-energy CT systems. The text emphasizes a deep understanding of how CT images are generated, the factors influencing image quality, and the critical importance of patient safety, including radiation dose management. It serves as an indispensable reference for radiographers, radiologists, medical physicists, and students seeking a comprehensive and up-to-date knowledge base in CT.

The book's main argument centers on providing a holistic view of CT, integrating theoretical knowledge with practical clinical relevance. It highlights the continuous advancements in CT technology and the need for practitioners to stay informed about new techniques, protocols, and safety guidelines to optimize diagnostic imaging. By detailing various clinical applications across different body systems, it demonstrates the broad utility of CT in modern medicine, while also stressing the ethical and practical considerations involved in its use. The inclusion of quality control aspects underscores the importance of maintaining high standards in CT imaging to ensure accurate diagnoses and patient well-being.

Key Takeaways

- A thorough understanding of CT physical principles is crucial for optimizing image quality and minimizing patient radiation dose.
- Effective quality control programs are essential to ensure the consistent performance and safety of CT systems.
- CT technology has evolved significantly, with multi-slice and dual-energy CT offering enhanced diagnostic capabilities and requiring specialized operational knowledge.
- Patient safety, particularly radiation dose management, must be a primary consideration in all CT imaging procedures.

- Clinical applications of CT span nearly all body systems, providing invaluable diagnostic information when applied appropriately.
- Image reconstruction algorithms and post-processing techniques are key to extracting maximum diagnostic information from raw CT data.
- Staying updated with technological advancements and best practices is vital for professionals working with computed tomography.

Chapter Summaries

Introduction to Computed Tomography

This chapter covers the historical development of CT, its fundamental concepts, and an overview of the CT imaging process. It sets the stage for subsequent detailed discussions on the technology, its applications, and quality control, providing a foundational understanding of how CT revolutionized medical diagnostics.

Physical Principles of CT

This section explores the underlying physics of CT, including X-ray production, interaction of X-rays with matter, attenuation, and the mathematical principles behind image reconstruction from projection data. It delves into the scientific basis that enables the creation of detailed cross-sectional images.

CT System Components

This chapter details the hardware components of a CT scanner, such as the X-ray tube, detectors, gantry, and computer system. It explains their individual functions, how they interact, and their role in the overall image acquisition process, from data collection to image display.

Image Reconstruction and Processing

This part discusses various image reconstruction algorithms, including filtered back projection and iterative reconstruction, which transform raw data into diagnostic images. It also covers post-processing techniques like multiplanar reformatting and 3D rendering that enhance visualization and analysis.

Image Quality and Artifacts

This chapter examines the factors influencing CT image quality, such as spatial resolution, contrast resolution, and noise. It identifies common artifacts that can degrade image quality and provides strategies for their reduction or elimination to ensure accurate diagnostic interpretation.

Patient Radiation Dose and Safety

This critical section addresses radiation dosimetry in CT, methods for dose reduction, and regulatory guidelines for patient protection. It emphasizes the importance of balancing diagnostic benefit with minimizing radiation exposure, detailing protocols for safe CT practice.

Clinical Applications of CT

This extensive chapter provides an overview of CT's diagnostic utility across various anatomical regions and medical conditions. It covers applications in the head, chest, abdomen, pelvis, and musculoskeletal system, illustrating the broad impact of CT in modern clinical practice.

Advanced CT Techniques

This section explores specialized CT applications such as spiral/helical CT, multi-slice CT (MSCT), dual-energy CT, CT angiography, and cardiac CT. It highlights the unique advantages and technical considerations of these advanced modalities for specific diagnostic challenges.

Quality Control in CT

This chapter outlines comprehensive quality assurance and control programs for CT scanners. It details daily, weekly, and annual tests and procedures necessary to ensure optimal system performance, image consistency, and patient safety, maintaining high standards in CT imaging.

Future Directions in CT

The concluding chapter discusses emerging technologies, research trends, and potential advancements in computed tomography. It explores innovations such as photon-counting detectors, artificial intelligence integration, and novel reconstruction methods, offering a glimpse into the future of CT imaging.

Themes

- CT Physics & Technology
- Clinical Diagnostic Imaging
- Patient Safety & Dose
- Image Quality Optimization
- Quality Assurance
- Technological Evolution

Frequently Asked Questions

What is COMPUTED TOMOGRAPHY Physical Principles, Clinical Applications, and Quality Control FOURTH EDITION about?

This book is a comprehensive textbook on computed tomography (CT), covering its foundational physical principles, a wide array of clinical applications across various body systems, and essential quality control procedures. It serves as a detailed guide for understanding CT technology, optimizing image acquisition, and ensuring patient safety.

Is COMPUTED TOMOGRAPHY Physical Principles, Clinical Applications, and Quality Control FOURTH EDITION worth reading?

Yes, it is highly recommended for anyone involved in CT imaging, including radiographers, radiologists, medical physicists, and students. Its thorough coverage, clear explanations, and focus on both theoretical and practical aspects make it an invaluable resource for professional development and education in the field.

How does COMPUTED TOMOGRAPHY Physical Principles, Clinical Applications, and Quality Control FOURTH EDITION end?

Spoiler: The book concludes by discussing future directions and emerging technologies in computed tomography, such as advanced detector designs and the integration of artificial intelligence. It emphasizes the continuous evolution of CT and the ongoing need for professionals to adapt to new advancements for improved patient care.

Who should read COMPUTED TOMOGRAPHY Physical Principles, Clinical Applications, and Quality Control FOURTH EDITION?

This book is ideal for radiography students, practicing radiographers, radiology residents, medical physicists, and other healthcare professionals who require a deep understanding of CT imaging. It is suitable for both educational purposes and as a comprehensive reference manual.

How long does it take to read COMPUTED TOMOGRAPHY Physical Principles, Clinical Applications, and Quality Control FOURTH EDITION?

Given its comprehensive nature and depth of technical detail, reading this textbook thoroughly would likely take between 30 to 50 hours, depending on the reader's prior knowledge and reading speed. It is designed for in-depth study rather than a quick read.