

CT PHYSICS

Mahadevappa Mahesh, MS, PhD

1. What is CT?

CT is a method for acquiring and reconstructing an image of a thin cross section of an object. It is based on measurements of x-ray attenuation through the section using many different projections. This is achieved by rotating both x-ray tube and detectors around the patient.

2. How is CT different from conventional radiographs?

CT differs from conventional radiography in two significant ways:

- CT forms a cross-sectional image, eliminating the superimposition of structures that occurs in plain film imaging because of compression of three-dimensional (3D) body structures onto the two-dimensional recording system.
- The sensitivity of CT to subtle differences in x-ray attenuation is at least a factor of 10 higher than normally achieved by film screen recording systems because of the virtual elimination of scatter.

3. What are the basic principles of CT?

Fundamentally a CT scanner makes many measurements of attenuation through the plane of a finite thickness cross section of the body. The system uses these data to reconstruct a digital image of the cross section in which each pixel in the image represents a measurement of the mean attenuation of a box-like element (voxel) extending through the thickness of the section. An attenuation measurement quantifies the fraction of radiation removed in passing through a given amount of a specific material of thickness Δx , as shown in Fig. 1-1. Attenuation is expressed as:

$$I_1 = I_0 e^{-\mu \Delta x}$$

where, I_1 and I_0 are the x-ray intensities measured with and without the material in the x-ray beam path, respectively, and μ is the linear attenuation coefficient of the specific material (see Fig. 1-1). The image reconstruction process, such as the filtered back-projection method and many other methods, are applied to derive the average attenuation coefficient (μ) values for each voxel in the cross section, using many rays from many different rotational angles around the cross section.

4. How is CT signal produced?

A CT signal results from tissue discrimination based on the variations in attenuation between "voxels," which depends on differences in voxel density and atomic number of elements present and is influenced by the detected mean photon energy.

5. What is a CT image?

A CT image as shown later is composed of pixels (picture elements). Each pixel on the image represents the average x-ray attenuation in a small volume (voxel) that extends through the tissue section. In Fig. 1-2, the pixel size is exaggerated. In addition, in a real CT image, all tissues within a single pixel would be the same shade of gray.

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RJ Shavelson

A red circular graphic with a gradient, appearing as a stylized arrow or a partial circle, located to the right of the name bar.

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Principles and Practice of Radiation Therapy Charles M. Washington, Dennis T. Leaver, 2015-04-01 The only radiation therapy text written by radiation therapists Principles and Practice of Radiation Therapy 4th Edition helps you understand cancer management and improve clinical techniques for delivering doses of radiation A problem based approach makes it easy to apply principles to treatment planning and delivery New to this edition are updates on current equipment procedures and treatment planning Written by radiation therapy experts Charles Washington and Dennis Leaver this comprehensive text will be useful throughout your radiation therapy courses and beyond Comprehensive coverage of radiation therapy includes a clear introduction and overview plus complete information on physics simulation and treatment planning Spotlights and shaded boxes identify the most important concepts End of chapter questions provide a useful review Chapter objectives key terms outlines and summaries make it easier to prioritize understand and retain key information Key terms are bolded and defined at first mention in the text and included in the glossary for easy reference UPDATED chemotherapy section expansion of What Causes Cancer and inclusions of additional cancer biology terms and principles provide the essential information needed for clinical success UPDATED coverage of post image manipulation techniques includes new material on Cone beam utilization MR imaging image guided therapy and kV imaging NEW section on radiation safety and misadministration of treatment beams addresses the most up to date practice requirements Content updates also include new ASRT Practice Standards and AHA Patient Care Partnership Standards keeping you current with practice requirements UPDATED full color insert is expanded to 32 pages and displays images from newer modalities [A Text-book of Physics](#) William Watson, 1920 **Dairy Science Abstracts** , 1946 [Bibliography of Agriculture](#) , 1974 **Science Abstracts** , 1959 **Arts & Humanities Citation Index** , 1981 A multidisciplinary index covering the journal literature of the arts and humanities It fully covers 1 144 of the world s leading arts and humanities journals and it indexes individually selected relevant items from over 6 800 major science and social science journals **CT Layman's Terms** Lawrence McNair, 2009-10-01 What s so tough about the concepts of CT Physics This book will help those who want to learn about CT Physics and who are inspiring to become CT Technologists [The Physics of CT Dosimetry](#) Robert L. Dixon, 2019-03-26 This book explores the physics of CT dosimetry and provides practical guidance on best practice for medical researchers and practitioners A rigorous description of the basic physics of CT dosimetry is presented and illustrates flaws of the current methodology It also contains helpful and rigorous shortcuts to reduce the measurement workload for medical physicists The mathematical rigor is accompanied by easily understood physical explanations and numerous illustrative figures Features Authored by a recognised expert in the field and award winning teacher Includes derivations for tube current modulation and variable pitch as well as stationary table techniques Explores abnormalities present in dose tracking software based on CTDI and presents methods to correct them **MDCT Physics: The Basics** Mahadevappa Mahesh, 2012-03-28 Written by the

chief physicist at Johns Hopkins University Hospital this easy to read short textbook explains the physics behind multi detector CT technology particularly newer more complex technology The focus is on principles of physics effects of scan parameters on image quality and optimum radiation dosage The book includes numerous key points summaries and questions to assist in exam preparation *CT Imaging* Alexander C. Mamourian, Harold I. Litt, 2013-03-14 After reading this book imagers and CT technologists should better understand the capabilities of modern multidetector CT scanners Imagers and technologists must understand how their scanners operate in order to take advantage of new capabilities for optimizing protocols that minimize patient dose In addition the reader will be better prepared to recognize the pitfalls and artifacts that appear on CT imaging Some of these are unfamiliar to most imagers and are the product of the large detector arrays offered on new CT scanners

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