Principles Of Magnetic Resonance Imaging A Signal Processing Perspective Spie Press

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Basic Principles of Magnetic Resonance Imaging Medical Physics Publishing Corporation
Magnetic Resonance Imaging is a very important clinical imaging tool. It combines different fields of physics and engineering in a uniquely complex way. MRI is also surprisingly versatile, 'pulse sequences' can be designed to yield many different types of contrast. This versatility is unique to MRI. This short book gives both an in depth account of the methods used for the operation and construction of modern MRI systems and also the principles of sequence design and many examples of applications. An important additional feature of this book is the detailed discussion of the mathematical principles used in building optimal MRI systems and for sequence design. The mathematical discussion is very suitable for undergraduates attending medical physics courses. It is also more complete than usually found in alternative books for physical scientists or more clinically orientated works.

Lessons Manual Elsevier
The first edition of this book was written in 1961 when I was Morris Loeb Lecturer in Physics at Harvard. In the preface I wrote: "The problem faced by a beginner today is enormous. If he attempts to read a current article, he often finds that the first paragraph refers to an earlier paper on which the whole article is based, and with which the author naturally assumes familiarity. That reference in turn is based on another, so the hapless student finds himself in a seemingly endless retreat. I have felt that graduate students or others beginning research in magnetic resonance needed a book which really went into the details of calculations, yet was aimed at the beginner rather than the expert. " The original goal was to treat only those topics that are essential to an understanding of the literature. Thus the goal was to be selective rather than comprehensive. With the passage of time, important new concepts were becoming so all-pervasive that I felt the need to add them. That led to the second edition, which Dr. Lotsch, Physics Editor of Springer-Verlag, encouraged me to write and which helped launch the Springer Series in Solid-State Sciences. Now, ten years later, that book (and its 1980 revised printing) is no longer available. Meanwhile, workers in magnetic resonance have continued to develop startling new insights.

MRI Academic Press
Quantitative Magnetic Resonance Imaging is a ‘go-to’ reference for methods and applications of quantitative magnetic resonance imaging, with specific sections on Relaxometry, Perfusion, and Diffusion. Each section will start with an explanation of the basic techniques for mapping the tissue property in question, including a description of the challenges that arise when using these basic approaches. For properties which can be measured in multiple ways, each of these basic methods will be described in separate chapters. Following the basics, a chapter in each section presents more advanced and recently proposed techniques for quantitative tissue property mapping, with a concluding chapter on clinical applications. The reader will learn: The basic physics behind tissue property mapping How to implement basic pulse sequences for the quantitative measurement of tissue properties The strengths and limitations to the basic and more rapid methods for mapping the magnetic relaxation properties T1, T2, and T2* The pros and cons for different approaches to mapping perfusion The methods of Diffusion-weighted imaging and how this approach can be used to generate diffusion tensor maps and more complex representations of diffusion How flow, magneto-electric tissue property, fat fraction, exchange, elastography, and temperature mapping

are performed How fast imaging approaches including parallel imaging, compressed sensing, and Magnetic Resonance Fingerprinting can be used to accelerate or improve tissue property mapping schemes How tissue property mapping is used clinically in different organs Structured to cater for MRI researchers and graduate students with a wide variety of backgrounds Explains basic methods for quantitatively measuring tissue properties with MRI - including T1, T2, perfusion, diffusion, fat and iron fraction, elastography, flow, susceptibility - enabling the implementation of pulse sequences to perform measurements Shows the limitations of the techniques and explains the challenges to the clinical adoption of these traditional methods, presenting the latest research in rapid quantitative imaging which has the possibility to tackle these challenges Each section contains a chapter explaining the basics of novel ideas for quantitative mapping, such as compressed sensing and Magnetic Resonance Fingerprinting-based approaches

Principles of Magnetic Resonance Imaging CRC Press

CMR is a powerful tool in the armamentarium of pediatric cardiology and health care workers caring for patients with congenital heart disease (CHD), but a successful study still presents major technical and clinical challenges. This text was created to give trainees, practitioners, allied professionals, and researchers a repository of dependable information and images to base their use of CMR on. Because CHD presents an intricate web of connections and associations that need to be deciphered, the imager performing CMR needs to understand not only anatomy, physiology, function, and surgery for CHD, but also the technical aspects of imaging. Written by experts from the world’s leading institutions, many of whom pioneered the techniques and strategies described, the text is organized in a logical way to provide a complete understanding of the issues involved. It is divided into three main parts: The Basics of CMR - familiarizes the reader with the minimum tools needed to understand the basics, such as evaluating morphology, ventricular function, and utilizing contrast agents CMR of Congenital and Acquired Pediatric Heart Disease - discusses broad categories of CHD and the use of CMR in specific disease states Special Topics in Pediatric Cardiac MR - covers other important areas such as the complementary role of CT scanning, interventional CMR, the role of the technologist in performing a CMR exam, and more With the ever increasing sophistication of technology, more can be done with CMR in a high quality manner in a shorter period of time than had been imagined as recently as just a few years ago. Principles and Practice of Cardiac Magnetic Resonance in Congenital Heart Disease: Form, Function, and Flow makes a major contribution to applying these techniques to improved patient care. An ideal introduction for the novice or just the curious, this reference will be equally useful to the seasoned practitioner who wants to keep pace with developments in the field and would like a repository of information and images readily availalble.

Advanced Principles of Magnetic Resonance Imaging Wiley-IEEE Press

This book is intended as a text/reference for students, researchers, and professors interested in physical and biomedical applications of Magnetic Resonance Imaging (MRI). Both the theoretical and practical aspects of MRI are emphasized. The book begins with a comprehensive discussion of the Nuclear Magnetic Resonance (NMR) phenomenon based on quantum mechanics and the classical theory of electromagnetism. The first three chapters of this book provide the foundation needed to understand the basic characteristics of MR images, e.g.,image contrast, spatial resolution, signal-to-noise ratio, common image artifacts. Then MRI applications are considered in the following five chapters. Both the theoretical and practical aspects of MRI are emphasized. The book ends with a discussion of instrumentation and the principles of signal detection in MRI. Clear progression from fundamental physical principles of NMR to MRI and its applications Extensive discussion of image acquisition and reconstruction of MRI Discussion of different mechanisms of MR image contrast Mathematical derivation of the signal-to-noise dependence on basic MR imaging parameters as well as field strength In-depth consideration of artifacts in MR images Comprehensive discussion of several techniques used for rapid MR imaging including rapid gradient-echo imaging, echo-planar imaging, fast spin-echo imaging and spiral imaging Qualitative discussion combined with mathematical description of MR techniques for imaging flow

Totally Accessible MRI Mosby Incorporated

Magnetic Resonance Imaging in Obstetrics and Gynecology focuses on the potential of magnetic resonance imaging (MRI) as a major imaging modality in the management of malignant diseases in the pelvis. This text is organized into two parts encompassing 11 chapters that provide images obtained by MRI in obstetrics and gynecology. Part one deals with the distinctive features of the normal uterus and vagina and those with carcinoma. It also presents the images of the benign disease and carcinomous ovary. Part 2 considers images of the maternal anatomy, placenta, fetus, and the gestational trophoblastic neoplasia. This book is of great value to obstetricians, gynecologists, and MRI technicians.

The Chemistry of Contrast Agents in Medical Magnetic Resonance Imaging John Wiley & Sons

Established as the leading textbook on imaging diagnosis of brain and spine disorders, Magnetic Resonance Imaging of the Brain and Spine is now in its Fourth Edition. This thoroughly updated two-volume reference delivers cutting-edge information on nearly every aspect of clinical neuroradiology. Expert neuroradiologists, innovative renowned MRI physicists, and experienced leading clinical neurospecialists from all over the world show how to generate state-of-the-art images and define diagnoses from crucial clinical/pathologic MR imaging correlations for neurologic, neurosurgical, and psychiatric diseases spanning fetal CNS anomalies to disorders of the aging brain. Highlights of this edition include over 6,800 images of remarkable quality, more color images, and new information using advanced techniques, including perfusion and diffusion MRI and functional MRI. A companion Website will offer the fully searchable text and an image bank.

Springer Science & Business Media

This practical guide offers an accessible introduction to the principles of MRI physics. Each chapter explains the why and how behind MRI physics. Readers will understand how altering MRI parameters will have many different consequences for image quality and the speed in which images are generated. Practical topics, selected for their value to clinical practice, include progressive changes in key MRI parameters, imaging time, and signal to noise ratio. A wealth of high quality illustrations, complemented by concise text, enables readers to gain a thorough understanding of the subject without requiring prior in-depth knowledge.

Principles of Magnetic Resonance Imaging Oxford University Press on Demand

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

Understanding Magnetic Resonance Imaging John Wiley & Sons

In 1971 Dr. Paul C. Lauterbur pioneered spatial information encoding principles that made image formation possible by using magnetic resonance signals. Now Lauterbur, "father of the MRI", and Dr. Zhi-Pei Liang have co-authored the first engineering textbook on magnetic resonance imaging. This long-awaited, definitive text will help undergraduate and graduate students of biomedical engineering, biomedical imaging scientists, radiologists, and electrical engineers gain an in-depth understanding of MRI principles. The authors use a signal processing approach to describe the fundamentals of magnetic resonance imaging. You will find a clear and rigorous discussion of these carefully selected essential topics: Mathematical fundamentals Signal generation and detection principles Signal characteristics Signal localization principles Image reconstruction techniques Image contrast mechanisms Image resolution, noise, and artifacts Fast-scan imaging Constrained reconstruction Complete with a comprehensive set of examples and homework problems, Principles of Magnetic Resonance Imaging is the must-read book to improve your knowledge of this revolutionary technique.

Hardware and System Component Design Elsevier Health Sciences

Diagnostic MRI in Dogs and Cats makes the vast and increasingly complex topic of clinical MRI in small animals accessible to all veterinarians. With the increasing availability of MRI technology, there is also a pressing need for expertise in interpreting these images. This is the first reference textbook to provide a well-illustrated and comprehensive overview of the current knowledge, focusing on imaging appearance rather than on clinical signs or treatment. With chapters on MRI physics and technology as well as sections on specific anatomical regions, the book functions as a stand-alone reference for the reader, whether they be a radiology/neurology resident in training or a practitioner with a need to learn about veterinary clinical MRI. Includes both evidenced-based material and the authors' personal experience, providing an excellent overview of current knowledge in the field. Contributors are international leaders in the field. Bullet points format and table summaries throughout the book keep the concepts concise and organized. Richly illustrated with over 650 annotated images showcasing the main features of the disease processes. Images are obtained at all magnet field strengths, so as to reflect the current reality of veterinary MRI, which uses low-, mid- and high-field magnets. The chapters on physics and MRI technology are concise and accessible, using many visual aids and diagrams, and avoiding abstract concepts and equations whenever possible. Within each anatomical section, each chapter focuses on a disease category of that body region. When it is important to understand the imaging appearance, the pathophysiology is reviewed and imaging features of prognostic relevance are detailed. This practical yet thoroughly comprehensive book is primarily an evidence-based learning resource for trainees, but will also aid practising veterinarians who have less MRI experience.

Principles of Magnetic Resonance Imaging Mosby Elsevier Health Science

Magnetic resonance imaging (MRI) is the most technically dependent imaging technique in radiology. To perform and interpret MRI studies correctly, an understanding of the basic underlying principles is essential. Understanding Magnetic Resonance Imaging explains the pulse sequences, imaging options, and coils used to produce MR images, providing a strong foundation for performing and interpreting imaging studies. The text is complemented by more than 100 figures and 25 photomicrographs illustrating the techniques discussed. Radiology residents, MR technologists, and radiologists should not be without Understanding Magnetic Resonance Imaging-the only single resource that explains all technical aspects of MRI, including recent advances, and presents all imaging options.

Instructor's Manual Cambridge University Press

Dette er en grundlæggende lærebog om konventionel MRI samt billedteknik. Den begynder med et overblik over elektricitet og magnetisme, herefter gives en dybtgående forklaring på hvordan MRI fungerer og her diskuteres de seneste metoder i radiografisk billedtagning, patientsikkerhed m.v.

Magnetic Resonance Imaging Elsevier Health Sciences

Atherosclerosis represents the leading cause of mortality and morbidity in the world. Two of the most common, severe, diseases that may occur, acute myocardial infarction and stroke, have their pathogenesis in the atherosclerosis that may affect the coronary arteries as well as the carotid/intra-cranial vessels. Therefore, in the past there was an extensive research in identifying pre-clinical atherosclerotic diseases in order to plan the correct therapeutical approach before the pathological events occur. In the last 20 years imaging techniques and in particular Computed Tomography and Magnetic Resonance had a tremendous improvement in their potential. In the field of the Computed Tomography the introduction of the multi-detector-row technology and more recently the use of dual energy and multi-spectral imaging provides an exquisite level of anatomic detail. The MR thanks to the use of strength magnetic field and extremely advanced sequences can image human vessels very quickly while offering an outstanding contrast resolution.

Magnetic Resonance Imaging of the Brain and Spine Morgan & Claypool Publishers

This fifth edition of the most accessible introduction to MRI principles and applications from renowned teachers in the field provides an understandable yet comprehensive update. Accessible introductory guide from renowned teachers in the field Provides a concise yet thorough introduction for MRI focusing on fundamental physics, pulse sequences, and clinical applications without presenting advanced math Takes a practical approach, including up-to-date protocols, and supports technical concepts with thorough explanations and illustrations Highlights sections that are directly relevant to radiology board exams Presents new information on the latest scan techniques and applications including 3 Tesla whole body scanners, safety issues, and the nephrotoxic effects of gadolinium-based contrast media

Principles of Magnetic Resonance Imaging Lippincott Williams & Wilkins

Preceded by Magnetic resonance imaging: physical principles and sequence design / E. Mark Haacke ... [et al.]. c1999.

Principles of Magnetic Resonance Imaging Springer

This book is a comprehensive and authoritative text on the expanding scope of CMR, dedicated to covering basic principles in detail focusing on the needs of cardiovascular imagers. The target audience for this book includes CMR specialists, trainees in CMR and cardiovascular medicine, cardiovascular physicists or clinical cardiovascular imagers. This book includes figures and CMR examples in the form of high-resolution still images and is divided in two sections: basic MRI physics, i.e. the nuts and bolts of MR imaging; and imaging techniques (pulse sequences) used in

cardiovascular MR imaging. Each imaging technique is discussed in a separate chapter that includes the physics and clinical applications (with cardiovascular examples) of a particular technique. Evolving techniques or research based techniques are discussed as well. This section covers both cardiac and vascular imaging. Cardiovascular magnetic resonance (CMR) imaging is now considered a clinically important imaging modality for patients with a wide variety of cardiovascular diseases. Recent developments in scanner hardware, imaging sequences, and analysis software have led to 3-dimensional, high-resolution imaging of the cardiovascular system. These developments have also influenced a wide variety of cardiovascular imaging applications and it is now routinely used in clinical practice in CMR laboratories around the world. The non-invasiveness and lack of ionizing radiation exposure make CMR uniquely important for patients whose clinical condition requires serial imaging follow-up. This is particularly true for patients with congenital heart disease (CHD) with or without surgical corrections who require lifelong clinical and imaging follow-up.

Basic Principles of Cardiovascular MRI John Wiley & Sons

Principles of Magnetic Resonance Imaging provides a contemporary introduction of the fundamental concepts of MRI and connects these concepts to the latest MRI developments. Graphic illustrations are used to clarify underlying biophysical processes, simplified calculations are derived to add precision in appreciating abstract concepts, and insightful interpretations are presented for biomedical information in MRI signal. This book contains three parts. I. Section the body into voxels, which describes the Fourier encoding matrix for an imaging system, realization of Fourier encoding using the gradient field in magnetic resonance, and k-space sampling. II. What's in a voxel, which examines the effects of the biophysical processes in a voxel on MRI signal. Intuitive biophysical models are developed for MRI signal dependence on Spin fluctuation in thermal microenvironment, which leads to T1/T2 relaxation rates reflecting cellular contents in a water voxel. Micro- and macro physiological motion, which includes diffusion, perfusion, flow and biomechanical motion. Molecular electron response to the B0 field, which leads to magnetic susceptibility and chemical shift. III. How to operate MRI, which describes MRI safety issue, hardware, software, MRI scanning and routine MRI protocols. This book also uses basic concepts to demonstrate and expose students to the latest technological innovations in MRI, including: B1+ B1- mapping, Electric property tomography (EPT), Quantitative susceptibility mapping (QSM), Chemical exchange saturation transfer (CEST), Contrast agents, Molecular MRI, Spin tagging (SPAMM and DENSE), MR elastography, Parallel imaging including SENSE and GRAPPA, Compressed sensing and Bayesian approach.

Physical and Biological Principles Morgan & Claypool Publishers

This highly successful book, details the underlying principles behind the use of magnetic field gradients to image molecular distribution and molecular motion, providing many examples by way of illustration. Following excellent reviews of the hardback edition the book is now available in paperback.

Magnetic Resonance Technology CRC Press

Magnetic resonance systems are used in almost every academic and industrial chemistry, physics and biochemistry department, as well as being one of the most important imaging modalities in clinical radiology. The design of such systems has become increasingly sophisticated over the years. Static magnetic fields increase continuously, large-scale arrays of receive elements are now ubiquitous in clinical MRI, cryogenic technology has become commonplace in high resolution NMR and is expanding rapidly in preclinical MRI, specialized high strength magnetic field gradients have been designed for studying the human connectome, and the commercial advent of ultra-high field human imaging has required new types of RF coils and static shim coils together with extensive electromagnetic simulations to ensure patient safety. This book covers the hardware and engineering that constitutes a magnetic resonance system, whether that be a high-resolution liquid or solid state system for NMR spectroscopy, a preclinical system for imaging animals or a clinical system used for human imaging. Written by a team of experts in the field, this book provides a comprehensive and instructional look at all aspects of current magnetic resonance technology, as well as outlooks for future developments.