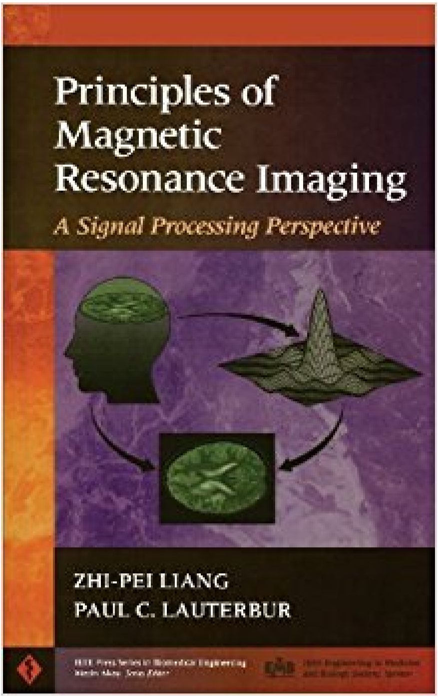
Principles Of Magnetic Resonance Imaging: A Signal Processing Perspective



Synopsis

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.

Book Information

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Customer Reviews

Biomedical/Electrical Engineering Principles of Magnetic Resonance Imaging A Signal Processing Perspective A volume in the IEEE Press Series in Biomedical Engineering Metin Akay, Series Editor Since its inception in 1971, MRI has developed into a premier tool for anatomical and functional imaging. Principles of Magnetic Resonance Imaging provides a clear and comprehensive treatment of MR image formation principles from a signal processing perspective. You will find discussion of these 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 Spatial information encoding Principles of Magnetic Resonance Imaging contains a comprehensive set of examples and homework problems. This textbook will provide students of biomedical engineering, biophysics, chemistry, electrical engineering, and radiology with a systematic, in-depth understanding of MRI principles.

About the Authors Zhi-Pei Liang is a faculty member in the Department of Electrical and Computer Engineering (ECE) and the Beckman Institute for Advanced Science and Technology at the University of Illinois at Urbana-Champaign (UIUC). Dr. Liang has contributed to the theory and applications of image reconstruction, constrained imaging, and image analysis. He received the Sylvia Sorkin Greenfield Best Paper Award of the Medical Physics Journal in 1990 and the National Science Foundation Career Award in 1995. Dr. Liang was named a Beckman Fellow of the UIUC Center for Advanced Study in 1997 and a Henry Magnuski Scholar for Outstanding Young Faculty Member in the ECE Department in 1999. Paul C. Lauterbur is a Center-for-Advanced-Study professor of Medical Information Sciences, Chemistry, and Molecular and Integrative Physiology and professor in the Center for Biophysics and Computational Biology, the Bioengineering Program, and the Beckman Institute all at the University of Illinois at Urbana-Champaign. Before conceiving of and demonstrating magnetic resonance imaging in 1971 1972, Dr. Lauterbur used nuclear magnetic resonance spectroscopy to study molecular structures. Among his numerous awards are the 1987 National Medal of Science, 1990 Bower Award and Prize for Achievement in Science, and 1994 Kyoto Prize for Advanced Technology. Dr. Lauterbur is a member of the National Academy of Sciences.

great condition

it is a new book, and it is very useful so actually everything is fine except that I waited for about 1 month.

First let me describe the book as to its production quality. This is one of the typical IEEE productions, namely the paper quality is on par with your local newspaper, the binding cracks upon opening, and they have the annoying "enhancements" of shading examples in gray which often makes them unreadable. I have had this problem with most IEEE books and for the price they charge they should at least provide some quality in production.Now to the content. The authors provide a comprehensive and detailed analysis of MRI and signal processing.My concerns relate to the following issues:1. MRI can be quite difficult. The reader must first understand the physics, then the signaling to effect a response signal, then the modulation of the response so as to select voxels to be detected, and then the Fourier analysis which produces the image. The reader, if approaching this for the first time, even a well educated signal processing engineer, should have a pathway to follow. The authors fail in this element. All the information is there, yet one must construct the framework.2. Certain equations are critical. Others take one along the path. For example, Eq 3.150 and 3.154 are essential. They are what makes MRI. However the authors just slide from one to the other and then from Eq 4.1-4.5 use these without regard to a reasonable transition. They introduce a function M, and one suspects it may be M(w) or M(z) or M(t). Having taught material like this at MIT and written books on the subject of signal processing, one must be careful to delineate key transitions and important equations.3. The authors have lots of equations but one gets lost in which ones count and how one should follow the "bread crumbs" to use a metaphor. The classic book by Van Trees on Detection and Estimation was the "gold standard" for taking the reader and/or student along the path and delineating key points and conclusions. In this text the authors just seem to jumble every equation together with equal value.4. The heart of MRI is the signals used to do phase and frequency transitions across the elements to be processed. The discussion in this book regarding that is, I feel, quite weak. One should be given a good intuitive feeling and then apply the mathematics. As I have often told my students, first explain what is happening and then apply the mathematics to "pretty it up". Here the authors have almost bludgeoned the reader with mathematics.The book contains great pearls, yet the quality of the printing, not the authors' fault, and the jumbling of every equation possible, leaves the reader wondering. A better press, publisher, and a rewrite with focus and builds of ideas would make this a great and much needed contribution to the field. It is clear that the authors know their material, it just needs fine tuning.

Magnetic resonance has recently recieved many riches in the form of excellent, definitive texts that have bundled together the advances of the last 20 or so years. Drs. Liang and Lauterbur have added to this trove by writing a text that goes beyond the standard descriptions of magnetic resonance image formation and including many advanced techniques available today, some of which they originated. The ideal audience for this text includes scientists, engineers, and physicians actively developing MRI applications from the physics on up. Though containing many recent developments it contains a core of medical imaging information that will not be outdated. The mathematical depth is sufficient to serve as a reference of basic and sophisticated methods but with enough pedagogical information to tutor the interested student. Liang and Lauterbur should be on the shelf of any serious professional or insightful student.

The selection of the chapters and the overall coverage of this book are excellent. It provides an outstanding and detailed description of MR physics and of how MR signals are generated and processed. However, not being an engineer or a physicist but a MD interested in MRI, I had some problems with the mathematical background required to understand the formulas used in this book. I feel that the book would be greatly improved if a more detailed explanation to the mathematics were given. At this point, I would recommend this book to graduate students or Ph.D.'s in physics, in biomedical or in electrical engineering, who want to understand in detail the principles of MR signal generation and processing. Because of the somewhat complicated mathematics, the book might be somewhat less destined, but still of interest, to radiologists and MRI physicians who, like me, want to enhance their understanding of MR physics and signal processing.

First, a confusing omission on p118, eqn: 4.28.The transverse component should be defined first as:Mx'y' = Mx' + i My' = ...This omission may be confusing when the previous chapter is not read before this one, as the definition of Mx'y' is not defined earlier in this chapter.p.123 eqn: 4.43,Mxy should be labeled Mx'y', Mx and My should be Mx' and My'There should be an equals sign after defining Mx(w,(t1+t2)+) + iMy(w,(t1+t2)+)

A very well-written book. It includes step-by-step analysis which leads beginners to gradually understand the concepts and physics. It is very good for textbook as well as for self learning.

This is an excellent textbook. Easy to follow if you are comfortable with Electromagnetics already. Lot's of math and examples inside. Make sure u get this book first, if you study MRI.

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