Magnetic Resonance Imaging: Theory and Practice. 3rd edition By M.T. Vlaardingerbroek and J.A. den Boer (Berlin: Springer-Verlag, 2002) pp. 499, ISBN 3-540-43681-2.

This is the third edition of this comprehensive analytical treatment of modern MRI physics and engineering. The book has grown in length from 349 pages in the first edition published in 1996 to 481 pages in the 1999 second edition to the 499 pages in this third edition. The major changes between the first and subsequent editions are the inclusion of an index, and a chapter on the partitioning of magnetization into configurations. The third edition contains some minor corrections and some slightly expanded image sections.

The book comprises seven chapters with the first chapter containing a basic summary of MR physics and instrumentation. Chapter two describes conventional imaging methods, e.g. spin echo and field (gradient) echo, using more formal mathematics and the use of k-space. Chapter three describes imaging methods using more advanced k-space trajectories, i.e. turbo (fast) spin echo (TSE), echo planar imaging (EPI), gradient spin echo (GRASE), spiral and radial techniques. A section discussing sources of artefact inherent to each sequence also accompanies the description of each method. Chapter four discusses gradient echo imaging techniques in which the magnetization is allowed to develop into the so-called steady state before image acquisition. This chapter presents mathematical descriptions of conventional gradient echo techniques generally known by their horrendous acronyms such as FLASH/SPGR/T1-FFE, FLASH/SPGR/T1-FFE, PSIF/SSFP/T2-FFE and true-FISP/FIESTA/B-FFE. Chapter five discusses the technique of fast gradient echo imaging by acquiring data in the transient state before a steady state can be established. There is a return to basics in chapter six with a discussion of contrast and signal-to-noise ratio (SNR). Contrast is addressed through the application of the standard Bloembergen, Pound and Purcell (BPP) theory of relaxation and includes a description of magnetization transfer contrast (MTC) as well as the action of exogenous contrast agents. The section on SNR discusses in detail the influence of hardware, reconstruction techniques and the patient on the achievable levels of signal and noise. Chapter seven provides a detailed treatise on the on the effects of flow and motion on the MR signal including a basic description of phase contrast, inflow and contrast-enhanced MR angiography techniques, including techniques based on magnetization preparation. The chapter finishes with sections on perfusion imaging, including arterial spin labelling, and diffusion imaging, including Q-space techniques. Chapter 8 concludes the book with the aforementioned discussion on the partitioning of magnetization into compartments. This technique is used to explain well-known techniques such as turbo spin echo (TSE) as well as more exotic sequences such as BURST. The chapter finishes with a discussion of RF pulse design using the Shinnar-LeRoux (SLR) algorithm.

Each chapter, with the exception of the first, is accompanied by a section of images illustrating some of the issues raised in the preceding chapter, together with detailed explanations.

MRI is renowned for the confusing variety of terms, abbreviations and acronyms that have developed over the years. In an attempt to establish a more coherent nomenclature the authors include an appendix proposing a systematic method of naming scan methods. The universal adoption of such a strategy would do much to reduce the confusion particularly between manufacturers’ proprietary names for what is essentially the same sequence. Sadly over this book’s six year period there is little evidence of such an approach in the literature.

Marinus Vlaardingerbroek, now retired, was formerly project leader for 1.5T MRI systems at Philips Medical Systems in The Netherlands whilst Jacques den Boer worked in MR Clinical Science at Philips. Unsurprisingly then the book is biased towards the methods employed by Philips with all images acquired using their commercial imaging systems. However, the principles of the various acquisition methods described are general enough to be applied to most imaging systems.

Overall this is an excellent comprehensive text for a postgraduate physics course in MR or as a reference in any MRI unit involved in research and development of MRI applications or system design.

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