
PREFACE

This book grew out of notes developed for a course in biomedical imaging in the Electrical and Computer Engineering Department at the University of Illinois at Urbana-Champaign. As part of the IEEE Press Series in Biomedical Engineering, the approach and level of the material are aimed at junior- to senior-level undergraduates in bioengineering and/or other engineering disciplines. The content, however, should also be suitable for practitioners in more clinically related professions in which imaging plays an important role. One of the major goals was to prepare a textbook that would be suitable for a one-semester course, with an integrated and consistent description of each imaging modality. This involved choosing areas to discuss in detail, survey, or ignore. Sources of additional material not included in this book are suggested at the end of this preface.

The approach of this book is to cover physical principles, instrumental design, data acquisition strategies, image reconstruction techniques, and clinical applications of the four imaging techniques most commonly used in clinical medicine as well as in academic and commercial research. The first four chapters cover, respectively, X-ray and computed tomography, nuclear medicine, ultrasonic imaging, and magnetic resonance imaging. In each chapter, particular emphasis is placed on the basic science and engineering design involved in each imaging modality. Recent developments, such as multislice spiral computed tomography, harmonic and subharmonic ultrasonic imaging, multislice positron emission tomography, and functional magnetic resonance imaging, are also highlighted. The sections on clinical applications are relatively brief, comprising a few examples illustrative of the types of images that provide useful diagnostic information. Many hundreds of specialized diagnostic clinical imaging books exist, written by authors far more expert in these areas. The fifth chapter deals with general image characteristics, such as spatial resolution and signal-to-noise ratio, common to all of the imaging modalities. Finally, two appendices cover basic mathematics and transform methods, again common to many of the modalities. Suggestions are made at the end of each chapter for further reading. These lists comprise a selection of original “classic” papers in each field, recent books and review articles covering specific aspects of an area in considerably more detail than possible here, and a list of journals specific to the particular imaging modality. These selections are by necessity somewhat subjective and certainly not comprehensive. Those readers interested in historical aspects of the development of medical imaging

