Principles of Computerized Tomographic Imaging

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Principles of Computerized Tomographic Imaging

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Preface

The purpose of this book is to provide a tutorial overview on the subject of computerized tomographic imaging. We expect the book to be useful for practicing engineers and scientists for gaining an understanding of what can and cannot be done with tomographic imaging. Toward this end, we have tried to strike a balance among purely algorithmic issues, topics dealing with how to generate data for reconstruction in different domains, and artifacts inherent to different data collection strategies.

Our hope is that the style of presentation used will also make the book useful for a beginning graduate course on the subject. The desired prerequisites for taking such a course will depend upon the aims of the instructor. If the instructor wishes to teach the course primarily at a theoretical level, with not much emphasis on computer implementations of the reconstruction algorithms, the book is mostly self-contained for graduate students in engineering, the sciences, and mathematics. On the other hand, if the instructor wishes to impart proficiency in the implementations, it would be desirable for the students to have had some prior experience with writing computer programs for digital signal or image processing. The introductory material we have included in Chapter 2 should help the reader review the relevant practical details in digital signal and image processing. There are no homework problems in the book, the reason being that in our own lecturing on the subject, we have tended to emphasize the implementation aspects and, therefore, the homework has consisted of writing computer programs for reconstruction algorithms.

The lists of references by no means constitute a complete bibliography on the subject. Basically, we have included those references that we have found useful in our own research over the years. Whenever possible, we have referenced books and review articles to provide the reader with entry points for more exhaustive literature citations. Except in isolated cases, we have not made any attempts to establish historical priorities. No value judgments should be implied by our including or excluding a particular work.

Many of our friends and colleagues deserve much credit for helping bring this book to fruition. This book draws heavily from research done at Purdue by our past and present colleagues and collaborators: Carl Crawford, Mani Azimi, David Nahamoo, Anders Andersen, S. X. Pan, Kris Dines, and Barry Roberts. A number of people, Carl Crawford, Rich Kulawiec, Gary S. Peterson, and the anonymous reviewers, helped us proofread the manuscript;

we are grateful for the errors they caught and we acknowledge that any errors that remain are our own fault. We are also grateful to Carl Crawford and Kevin King at GE Medical Systems Division, Greg Kirk at Resonex, Dennis Parker at the University of Utah, and Kris Dines of XDATA, for sharing their knowledge with us about many newly emerging aspects of medical imaging.

Our editor, Randi Scholnick, at the IEEE PRESS was most patient with us; her critical eye did much to improve the quality of this work.

Sharon Katz, technical illustrator for the School of Electrical Engineering at Purdue University, was absolutely wonderful. She produced most of the illustrations in this book and always did it with the utmost professionalism and a smile. Also, Pat Kerkhoff (Purdue), and Tammy Duarte, Amy Atkinson, and Robin Wallace (SPAR) provided excellent secretarial support, even in the face of deadlines and garbled instructions.

Finally, one of the authors (M.S.) would like to acknowledge the support of his friend Kris Meade during the long time it took to finish this project.

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