Preface

This text addresses the topics covered in ten lectures delivered by the author during the 2012 CBMS-NSF conference "Mathematical methods of computed tomography." The goals of the lectures were

- to describe the main problems and techniques of some well-established imaging modalities,

- to emphasize the most important mathematical ideas involved, and

- to give a brief overview of several imaging techniques that are less common and/or currently being developed.

Writing this text, though, I realized that a more precise (and modest) title should be "The Radon Transform and Medical Imaging." Indeed, I mostly (but not exclusively) concentrate on modalities allowing integral geometry approaches. Moreover, all the techniques I discuss in any detail come from medical imaging.

The audience of the conference included a wide range of people—from graduate students to mature researchers. These lectures aim to the same mixed crowd. This is why I have tried to keep the exposition self-contained as much as possible, with some background information included in Appendices. Experts should in most cases skip those, to avoid feeling patronized.

I have also tried to keep technicalities to a minimum, emphasizing the main mathematical ideas, with details to be developed to the full extent by the reader and/or found in the literature. In many cases I just provide pointers to the literature.

Concerning the list of the references, it could have grown indefinitely if I tried to make it comprehensive (and even then it would not be complete). I tried to make sure that the reader is referred to main surveys and monographs, and when needed, to original papers. In the case of the many areas that I could touch only tangentially, I threw in a hodgepodge of related pointers, hoping that the reader will dig out further information and references from there. You will be the judges of how well I succeeded.

I also have to confess that the book is addressing mostly analytic techniques. Thus, the highly nontrivial numerical issues—discretization, sampling, efficient algorithms, etc.—are mentioned only in passing in Chapter 9, with pointers to the literature provided.

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