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Sinopsis

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Inverse problems arise when we reconstruct a sharper image from a blurred one or reconstruct the underground mass density from measurements of the gravity above the ground. When we solve an inverse problem, we compute the source that gives rise to some observed data using a mathematical model for the relation between the source and the data.

This book gives an introduction to the practical treatment of inverse problems by means of numerical methods, with a focus on basic mathematical and computational aspects. To solve inverse problems, we demonstrate that insight about them goes hand in hand with algorithms.

Discrete Inverse Problems: Insight and Algorithms includes a number of tutorial exercises that give the reader hands-on experience with the methods, difficulties, and challenges associated with the treatment of inverse problems. It also includes examples and figures that illustrate the theory and algorithms.

Audience
This book is written for graduate students, researchers, and professionals in engineering and other areas that depend on solving inverse problems with noisy data. The aim is to provide readers with enough background that they can solve simple inverse problems and read more advanced literature on the subject.

Contents
Preface;
List of Symbols;
Chapter 1: Introduction and Motivation;
Chapter 2: Meet the Fredholm Integral Equation of the First Kind;
Chapter 3: Getting to Business: Discretizations of Linear Inverse Problems;
Chapter 4: Computational Aspects: Regularization Methods;
Chapter 5: Getting Serious: Choosing the Regularization Parameter;

Chapter 6: Toward Real-World Problems: Iterative Regularization;
Chapter 7: Regularization Methods at Work: Solving Real Problems;
Chapter 8: Beyond the 2-Norm: The Use of Discrete Smoothing Norms;
Appendix A: Linear Algebra Stuff;
Appendix B: Symmetric Toeplitz-Plus-Hankel Matrices and the DCT;
Appendix C: Early Work on ?Tikhonov Regularization?;
Bibliography;
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About the Author

Per Christian Hansen is Professor of Scientific Computing at the Technical University of Denmark. His publications include two other books on inverse problems, several MATLAB® packages, and many papers on inverse problems, matrix computations, and signal processing. His home page is http://www2.imm.dtu.dk/~pch/.

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Keywords

inverse problems, regularization, parameter choice, iterative methods, numerical methods