Contents

1 Introduction 2

2 Inverse Problems Modeled by Integral Equations of the First Kind: Causation 5

2.1 Some Models 6
2.2 Integral Equations of the First Kind 35
2.3 Bibliographic Notes 39

3 Parameter Estimation in Differential Equations: Model Identification 41

3.1 An Exponential Growth Model 43
3.2 A Problem in Hydraulics 45
3.3 Compartmental Analysis 49
3.4 Structural Dynamics 56
3.5 Diffusion Coefficients 61
3.6 Forcing Terms 63
3.7 Bibliographic Notes 65

4 Mathematical Background for Inverse Problems 67

4.1 A Function Space Précis 67
4.2 Some Operator Theory 71
4.3 Ill-Posed Operator Equations 79
4.4 Bibliographic Notes 83

5 Some Methodology for Inverse Problems 84

5.1 The Method of Regularization 84
5.2 Discretization Methods 91
5.3 Iterative Methods 96
5.4 TSVD 100
5.5 The Maximum Entropy Method 102
5.6 The Backus-Gilbert Method 108
5.7 ART 112
5.8 Ouput Least Squares 116
5.9 Bibliographic Notes 119

6 An Annotated Bibliography on Inverse Problems 121

Index 151