

# Contents

<b>Preface</b>	<b>ix</b>
<b>1 Inverse Scattering in Two Dimensions</b>	<b>1</b>
1.1 Introduction . . . . .	1
1.2 Classical Inversion Techniques . . . . .	4
1.3 The Linear Sampling Method . . . . .	7
1.4 Regularization of the LSM . . . . .	9
1.5 Numerical Results in Two Dimensions . . . . .	11
1.5.1 Scattering by a Circular Cylinder . . . . .	12
1.5.2 Two Scatterers Using Synthetic Data . . . . .	14
1.5.3 Real Data . . . . .	16
<b>2 Maxwell's Equations</b>	<b>19</b>
2.1 The Scattering of Electromagnetic Waves . . . . .	19
2.2 The Stratton–Chu Formulae and Their Application . . . . .	21
2.3 Vector Wave Functions and Electromagnetic Herglotz Pairs . . . . .	25
<b>3 The Inverse Scattering Problem for Obstacles</b>	<b>29</b>
3.1 A Uniqueness Theorem . . . . .	30
3.2 Approximation Properties of Electromagnetic Herglotz Pairs . . . . .	32
3.3 The Linear Sampling Method . . . . .	38
3.4 Limited Aperture Data . . . . .	45
3.5 Numerical Examples in Three Dimensions . . . . .	46
3.5.1 A Disconnected Scatterer: Two Balls . . . . .	47
3.5.2 The Teapot . . . . .	49
3.5.3 Impedance Cube . . . . .	49
3.5.4 Reconstruction of $\lambda$ and Limited Aperture . . . . .	50
<b>4 The Inverse Scattering Problem for Anisotropic Media</b>	<b>53</b>
4.1 Uniqueness Theorems . . . . .	55
4.2 The Interior Transmission Problem . . . . .	69
4.3 Determination of the Support . . . . .	76
4.4 A Lower Bound for $\ N\ _2$ . . . . .	80
4.5 The Existence of Transmission Eigenvalues . . . . .	83
4.6 Partially Coated Objects . . . . .	89

---

<b>5</b>	<b>The Inverse Scattering Problem for Thin Objects</b>	<b>93</b>
5.1	Scattering by Thin Objects . . . . .	93
5.2	Approximation Theorems . . . . .	97
5.3	Solution of the Inverse Problem . . . . .	99
5.4	Numerical Reconstruction of Screens . . . . .	105
<b>6</b>	<b>The Inverse Scattering Problem for Buried Objects</b>	<b>107</b>
6.1	Scattering by Buried Objects . . . . .	108
6.2	Near Field Data . . . . .	110
6.3	The Reciprocity Gap Functional Method . . . . .	112
6.4	Numerical Reconstruction of Buried Objects . . . . .	126
	<b>Bibliography</b>	<b>129</b>
	<b>Index</b>	<b>137</b>