Qualitative Methods in Inverse Scattering Theory

An Introduction

With 14 Figures



Contents

1	Functional Analysis and Sobolev Spaces			
	1.1	Normed Spaces	1	
	1.2	Bounded Linear Operators	6	
	1.3	The Adjoint Operator	13	
	1.4	The Sobolev Space $H^p[0, 2\pi]$	17	
	1.5	The Sobolev Space $H^p(\partial D)$	22	
2	Ill-Posed Problems			
	2.1	Regularization Methods	28	
	2.2	Singular Value Decomposition	30	
	2.3	Tikhonov Regularization	36	
3	Sca	ttering by an Imperfect Conductor	45	
	3.1	Maxwell's Equations	45	
	3.2	Bessel Functions	47	
	3.3	The Direct Scattering Problem	51	
4	The Inverse Scattering Problem			
	for	an Imperfect Conductor	61	
	4.1	Far Field Patterns	62	
	4.2	Uniqueness Theorems for the Inverse Problem	65	
	4.3	The Linear Sampling Method	69	
	4.4	Determination of the Surface Impedance	76	
	4.5	Limited Aperture Data	79	
5	Scattering by an Orthotropic Medium 81			
	5.1	Maxwell Equations for an Orthotropic Medium	81	
	5.2	Mathematical Formulation		
		of the Direct Scattering Problem	85	
	5.3	Variational Methods	89	
	5.4	Solution of the Direct Scattering Problem	101	

.

6	The Inverse Scattering Problem		
	for	an Orthotropic Medium	
	6.1	Formulation of the Inverse Problem	
	6.2	The Interior Transmission Problem	
	6.3	Uniqueness	
	6.4	The Linear Sampling Method120	
7	The	Factorization Method	
	7.1	Preliminary Results	
	7.2	Properties of the Far Field Operator	
	7.3	The Factorization Method146	
	7.4	Closing Remarks	
8	Mixed Boundary Value Problems		
	8.1	Scattering by a Partially Coated Perfect Conductor	
	8.2	The Inverse Scattering Problem for a Partially Coated	
		Perfect Conductor	
	8.3	Numerical Examples	
	8.4	Scattering by a Partially Coated Dielectric	
	8.5	The Inverse Scattering Problem	
		for a Partially Coated Dielectric	
	8.6	Numerical Examples	
	8.7	Scattering by Cracks	
	8.8	The Inverse Scattering Problem for Cracks	
	8.9	Numerical Examples	
9	AC	Glimpse at Maxwell's Equations	
Re	feren	ces	
Ind	lex .		