

Contents

Foreword by V. G. Yakhno

vii

1. Introduction	1
1.1. Inverse problem concept: examples of formulating inverse problems	1
1.2. On correctness of direct and inverse problems of mathematical physics	11
2. Inverse problems for the operator $L_q = (\partial^2/\partial t^2) - (\partial^2/\partial x^2) + q(x)$	18
2.1. Problems with nonfocused initial data	18
2.2. Some aspects associated with the inverse problem for the equation $L_q u = F$	29
2.3. Problems with a focused source of disturbance	32
2.4. Reducing the problem with a focused source of disturbance to a linear integral equation: necessary and sufficient conditions for the inverse problem solvability	39
2.5. Inverse problems for differential equations in a limited domain	46
2.6. Relationship with the Sturm–Liouville problem	53
2.7. One-dimensional inverse problems for second-order linear hyperbolic equations	57
2.8. Problem of determining the operator L_q in a second-order hyperbolic equation	62
3. Inverse kinematic problems in seismology	64
3.1. Iconical equations, rays, and fronts	64
3.2. Boundary rays; waveguides: a sufficient condition for the absence of waveguides and boundary rays—ray regularity	69
3.3. One-dimensional inverse kinematic problems	74
3.4. Linearized three-dimensional inverse problems	80
3.5. Nonlinear three-dimensional inverse problems	92
3.6. Inverse problems using inner sources	96
3.7. Inverse kinematic problems for an anisotropic medium	97
4. Second-order equations of a hyperbolic type and related inverse problems	111
4.1. Fundamental solution and its differential properties	111
4.2. Ray formulation of inverse problems for the coefficients at minor derivatives	121

4.3. Inverse dynamic problem: linearization method	134
4.4. General scheme of studying inverse problems for hyperbolic type equations	141
5. Inverse problems for first-order linear hyperbolic systems	149
5.1. Systems of equations with a single spatial variable	149
5.2. Inverse problems using focused sources of wave generation	155
5.3. Problem of determining the right-hand part of a hyperbolic system	163
5.4. Lamb one-dimensional inverse problem	166
5.5. Lamb three-dimensional inverse problem within a linear approach	177
5.6. Inverse problem for a system of Maxwell equations	191
6. Inverse problems for parabolic and elliptical type second-order equations	208
6.1. Problem of determining the density of heat sources	208
6.2. Problem of determining diffusion coefficients	210
6.3. Relations among inverse problems for parabolic, elliptical, and hyperbolic type equations	213
6.4. On specific formulations of inverse problems where the coefficient to be determined is independent of one of the variables	218
<i>References</i>	221
<i>Index</i>	240