

Contents

Preface, V

Introduction, 1

Chapter I. Mathematical Preliminaries, 5

1. Probability and Random Variables, 5
2. Random Functions, 12
3. Stochastic Differential Equations, 23
4. Functional Derivatives, 31

Chapter II. Stochastic Media; Models and Analysis, 38

5. Introduction. Phenomenological Deterministic Models, 38
6. Stochastic Media, 42
 - 6.1. General Considerations, 42
 - 6.2. Continuous Stochastic Media, 44
 - 6.3. Discrete Stochastic Media. Examples, 45
7. Homogenization; Effective Parameters, 51
8. Hierarchy Equations for Moments, 53
9. Equations for the Mean Field; the Dyson Equation, 56
10. The Bethe–Salpeter Equation, 63

Chapter III. Wave Propagation in Continuous Stochastic Media, 65

11. Introduction 65
12. Method of Small Perturbations; the Born Approximation, 72
 - 12.1. The Born Approximation; Scalar Waves, 72
 - 12.2. Second Approximation; Parameters of the Mean Wave 79
 - 12.3. Born Approximation; Vector Elastic Waves, 82
13. Geometrical Optics in a Stochastic Medium 90
14. Rytov Method and Its Validity 97
15. Diffusion (Parabolic) Approximation 102
16. Smoothing Method; Effective parameters, 105
 - 16.1. Scalar Waves, 106
 - 16.2. Elastic Wave Propagation in a Stochastic Solid, 110
 - 16.3. Thermoelastic Waves, 112
 - 16.4. Electromagnetic Waves, 116
 - 16.5. Magnetoelastic Waves, 119
17. Reflection and Transmission by a Bounded Stochastic Medium, 121
 - 17.1. Application of a Smoothing Method, 121
 - 17.2. Markov Process Approach, 124

- 18. Functional Approach to Stochastic Wave Analysis, 128
 - 18.1. Equations for the Characteristic Functional, 128
 - 18.2. Application of the Wiener Integral, 133
 - 18.3. Furutsu–Novikov Formula; Moments of Wave Field, 139
- 19. Perturbation Theory and the Diagram Technique, 148
- 20. On Probability Distributions of a Scattered Field, 152
- 21. Other Related Problems, 154
- Chapter IV. Wave Propagation in Discrete Stochastic Media, 159
 - 22. Introduction, 159
 - 23. Scalar Waves; Foldy’s Approximation, 162
 - 24. Elastic Vector Waves; Random Distribution of Inclusions, 167
 - 24.1. Formulation, 167
 - 24.2. Description of the Scattering Mechanism; Average Total Field, 168
 - 24.3. Single Scattering at a Random Configuration of Spherical Inclusions, 178
 - 24.4. Multiple Scattering; Effective Parameters, 184
 - 25. Wave Propagation in Layered Stochastic Media, 191
 - 26. Reverberation Processes, 197
 - 27. Other Related Problems, 200
- Chapter V. Scattering of Waves at Stochastic Surfaces, 201
 - 28. Introduction, 201
 - 29. Wave Scattering at Rough Surfaces; Basic Methods, 204
 - 29.1. Rayleigh’s Method, 204
 - 29.2. Method of Small Perturbations, 205
 - 29.3. Kirchhoff Method, 207
 - 29.4. The Integral Equation Method, 210
 - 30. Scattering of Scalar Waves; the Kirchhoff Method, 211
 - 30.1. The Scattered Field, 211
 - 30.2. Probabilistic Properties of a Scattered Field, 214
 - 31. Scattering of Elastic Rayleigh Waves; the Method of Small Perturbations, 217
 - 31.1. Formulation. Boundary Conditions, 217
 - 31.2. Scattered Waves. Probabilistic Properties of Attenuation, 220
 - 32. Reflection from Surfaces with Random Impedance, 224
 - 32.1. General Formulation, 224
 - 32.2. Reflection Coefficient of a Mean Field, 226
 - 33. Other Related Problems, 230
- Bibliography, 232
- Subject Index, 246

