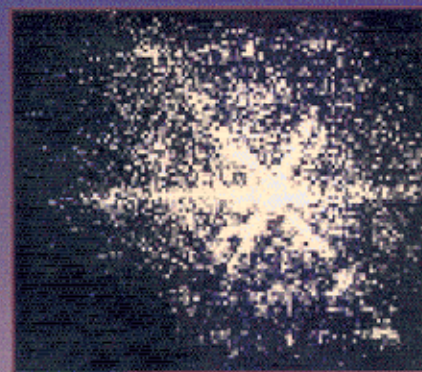
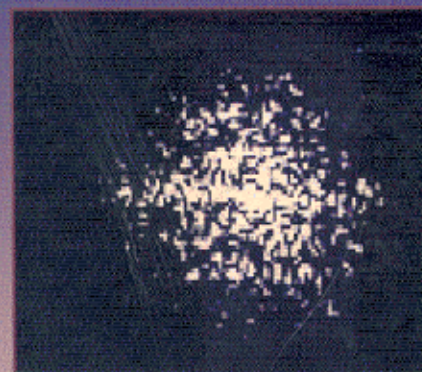
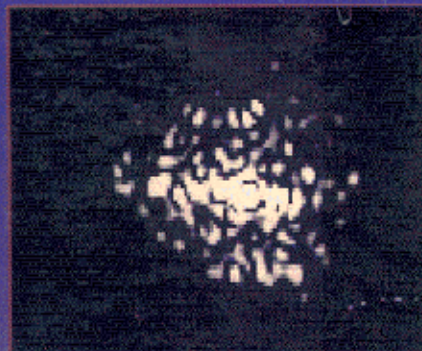


COHERENT FIELDS AND IMAGES IN REMOTE SENSING

VALERY I. MANDROSOV



Contents

Preface / ix

Notation / xv

Explanation of Terms / xix

Chapter 1 Basic Concepts of the Statistical Theory of Light Scattering / 1

- 1.1 Introduction / 1
- 1.2 Random surfaces and fields scattered by them; the Kirchhoff method / 1
- 1.3 Statistical characteristics of a field scattered by a stationary object of finite size / 18
- 1.4 Statistical characteristics of fields scattered by a moving object / 27
- 1.5 Conclusions / 37

Chapter 2 Statistical Description of Coherent Images / 39

- 2.1 Introduction / 39
- 2.2 Statistical properties of fields in coherent images / 40
- 2.3 Statistical characteristics of coherent image intensity in nonflat rough objects / 53
- 2.4 Methods of estimating and improving the quality of coherent images / 56
- 2.5 Statistical characteristics of images of an object illuminated by quasi-monochromatic and polychromatic light / 60
- 2.6 Coherent images of small-scale surface roughness / 64
- 2.7 Speckle structure of the time spectrum of a coherent field scattered by a moving rough object / 70
- 2.8 Conclusions / 72
- 2.9 General conclusions to Chapters 1 and 2 / 74

Chapter 3 Use of Coherent Fields and Images to Determine the Dynamic Parameters of Remote Objects / 75

- 3.1 Introduction / 75
- 3.2 Methods of determining the linear velocity of a remote rough object / 76
- 3.3 Method of determining the angular velocity of a rotating object / 83
- 3.4 Determining object surface deformation parameters / 92
- 3.5 Combined method of determining the motion and deformation parameters of an object / 98
- 3.6 Conclusions / 100

Chapter 4 Fourier Telescopy / 103

- 4.1 Introduction / 103
- 4.2 Statistical model of the received signal in Fourier telescopy and the Fourier-telescopic image / 105
- 4.3 Fourier-telescopic panoramic microscope / 118
- 4.4 Integral and local measures of the relationship between the Fourier-telescopic image of an object and its averaged undistorted image / 122
- 4.5 Conclusions / 126

Chapter 5 Time Background Holography of Moving Objects / 129

- 5.1 Introduction / 129
- 5.2 General theory of time background holography / 131
- 5.3 Using time background holography to detect a moving object / 139
- 5.4 Application of time background holography to the fast detection of moving objects and determination of their parameters / 148
- 5.5 Time background holography of moving objects placed close to the background surface; the principle of time averaging of coherent wavefields / 157
- 5.6 Time background intensity holography / 169
- 5.7 Conclusions / 175

Appendix 1 Statistical Characteristics of the Intensity Distribution in a Coherent Image / 177**Appendix 2 Statistical Characteristics of the Intensity Distribution in a Fourier-Telescopic Image and the Resolution of Fourier Telescopy / 183****Appendix 3 Phase Closure Algorithm in Fourier Telescopy / 191**

**Appendix 4 The Coherence of Fields Scattered by Sufficiently Large
Rough Objects, and the Contrast of the Scattered Field
Intensity Distribution / 195**

**Appendix 5 Physics of Speckle Pattern Formation in the Images of Rough
Objects / 205**

References / 211

Index / 217