CONTENTS

Preface *ix*
Acknowledgments *xi*
Frequently Used Notations *xiii*

Introduction 1

PART I SEARCH GAMES IN COMPACT SPACES 7

Chapter 1 **General Framework** 9

Chapter 2 **Search For an Immobile Hider** 17

2.1 General Results 17
2.2 Search in a Graph 23
2.3 Search on a Tree 29
2.4 The Case of an Odd Number of Arcs Connecting Two Points 33
2.5 Search in a Multidimensional Region 39
2.6 Nonhomogeneous Search Spaces 42

Chapter 3 **Search for a Mobile Hider** 47

3.1 General Framework 47
3.2 Search on k Arcs 51
3.3 Search on a Circle 58
3.4 An Open Problem 61

Chapter 4 **Mobile Hider in a Multidimensional Region** 65

4.1 General Description 65
4.2 Strategy of the Searcher 66
4.3 Strategy of the Hider 77
4.4 Extensions of the Previous Results 86
4.5 A General Cost Function 90
4.6 Search for an Infiltrator 96

PART II SEARCH GAMES IN UNBOUNDED DOMAINS 99

Chapter 5 **General Framework** 101

5.1 One-Dimensional Search Games 101
5.2 Multidimensional Search Games 106

Chapter 6 **On the Optimality of the Exponential Functions for Some Minimax Problems** 109

6.1 Introduction 109
6.2 Required Properties of F for the Discrete Case 110
6.3 Discrete Minimax Theorems 112
6.4 Minimax Theorems for the Continuous Case 119
6.5 Uniqueness of the Minimax Strategy 128

Chapter 7 **Search on the Infinite Line** 137

7.1 Introduction 137
7.2 The Minimax Search Trajectory 141
7.3 Optimal Strategies 143
7.4 Another Approach to the Search on the Line 151
7.5 Search for a Moving Hider 152
7.6 Search with Probability of Detection Less Than 1 157

Chapter 8 **Application of the Minimax Theorems to Some Other Search Problems** 161

8.1 Search on M Rays 161
8.2 Search for a Point in the Plane 172
8.3 "Swimming in a Fog" Problems 176

Appendixes 179

Appendix 1 **On the Existence of a Value for Search Games** 181
Appendix 2 **Theorems about the Attainment of Exponential Functions** 189
Appendix 3 **Discrete Search Games** 201
Appendix 4 **Some Basic Notions of the Theory of Games** 205
References 209
Index 215