

Contents

Part I. Uncertainty and Decisions

Facets of Robust Decisions	3
<i>Y. Ermoliev, L. Hordijk</i>	
1 Introduction	3
2 Concepts of Robustness	5
3 Decision Problems Under Uncertainty	7
4 Uncertainty Modeling	10
5 Robust Stochastic Optimization	14
6 Temporal, Spatial and Social Heterogeneities	18
7 STO Methods for Robust Solutions	20
8 Sensitivity of Robust Strategies	22
9 Concluding Remarks	25
References	26
Stress Testing via Contamination	29
<i>J. Dupačová</i>	
1 Introduction	29
2 Motivation: Stochastic Dedicated Bond Portfolio Management	31
3 Contamination and Stress Testing	32
4 Contamination and Stress Testing for CVaR	39
5 Conclusions	44
References	45
Structured Modeling for Coping with Uncertainty in Complex Problems	47
<i>M. Makowski</i>	
1 Introduction	47
2 Context	49
3 Uncertainty and Risk	50
4 Structured Modeling	54
5 Conclusions	60
References	61

Part II. Modeling Stochastic Uncertainty

Using Monte Carlo Simulation to Treat Physical Uncertainties in Structural Reliability	67
<i>D. C. Charmpis, G. I. Schuëller</i>	
1 Introduction	67

2	Direct Monte Carlo Simulation	69
3	Variance Reduction Techniques	70
4	Computational Efficiency Issues	74
5	Applications	76
6	Closing Remarks	81
	References	82

Explicit Methods for the Computation of Structural Reliabilities in Stochastic Plastic Analysis 85

I. Kaymaz, K. Marti

1	Stochastic Plasticity Analysis	86
2	First Order Reliability Method (FORM)	90
3	Response Surface Method	91
4	Examples	96
5	Conclusions	102
	References	102

Statistical Analysis of Catastrophic Events 105

J. L. Teugels, B. Vandewalle

1	WMO-Release 695	105
2	Extreme Value Statistics	106
3	SWISS-RE Casualties Table	112
4	Concluding Remarks	116
	References	117

Scene Interpretation Using Bayesian Network Fragments 119

P. Lueders

1	Introduction	119
2	Representation	120
3	Scene Interpretation	125
4	Related Work	128
5	Conclusion	128
	References	129

Part III. Non-Probabilistic Uncertainty

General Equilibrium Models with Discrete Choices in a Spatial Continuum 133

M. Keyzer, Y. Ermoliev, V. Norkin

1	Introduction	133
2	The Continuum of Agents: Distribution of Spatial and Social Characteristics	136
3	Producer Behavior	139
4	Consumer Behavior	142
5	Existence of a Competitive Equilibrium	146

6 Spatial Welfare Optimum: a Dual Approach 147
 7 Deterministic Versus Stochastic Welfare Tâtonnement 151
 References 153

**Sequential Downscaling Methods
 for Estimation from Aggregate Data 155**

G. Fischer, T. Ermolieva, Y. Ermoliev, H. Van Velthuizen
 1 Introduction 155
 2 Downscaling Problems: Motivating Examples 157
 3 Sequential Downscaling Methods 160
 4 Minimax Likelihood and Maximum Entropy 163
 5 Practical Applications 165
 6 Concluding Remarks 167
 References 168

Optimal Control for a Class of Uncertain Systems 171

F.L.Chernousko
 1 Introduction 171
 2 Statement of the Problem 172
 3 Transformations 173
 4 Solution of the Problem 174
 5 Linear-Quadratic Performance Index 177
 6 Examples 177
 7 Conclusions 182
 References 183

Uncertainties in Medical Processes Control 185

A.G.Nakonechny, V.P.Marzeniuk
 1 Introduction 185
 2 Generalized Pathologic Process 186
 3 Simplified Model 189
 4 Uncertainties 190
 5 Conclusions 192
 References 192

Part IV. Applications of Stochastic Optimization

**Impacts of Uncertainty and Increasing Returns on Sustainable
 Energy Development and Climate Change:**

A Stochastic Optimization Approach 195

A. Gritsevskiy, H.-H. Rogner
 1 Introduction 195
 2 Modeling Approach and a Motivating Example 197
 3 Model Structure 201
 4 Implementation 209

5	Concluding Observations	211
	References	214
Stochasticity in Electric Energy Systems Planning		217
<i>A. Ramos, S. Cerisola, Á. Baíllo, J. M. Latorre</i>		
1	Introduction	217
2	Uncertainty Impact	218
3	Estimation Methods	220
4	Decision Making Methods	222
5	Characteristic Models	224
6	Conclusions	238
	References	238
Stochastic Programming Based PERT Modeling		241
<i>A. Gouda, D. Monhor, T. Szántai</i>		
1	Introduction	241
2	The Stochastic Programming Model of PERT	242
3	Numerical Results	243
	References	254
Towards Implementable Nonlinear Stochastic Programming ..		257
<i>L. Sakalauskas</i>		
1	Introduction	257
2	Stochastic Differentiation and Monte-Carlo Estimators	259
3	Statistical Verification of the Optimality Hypothesis	262
4	Optimization by Monte-Carlo Estimators with Sample Size Regulation	265
5	Numerical Study of Algorithms	271
6	Discussion and Conclusions	277
	References	278

Part V. Policy Issues Under Uncertainty

Endogenous Risks and Learning in Climate Change Decision Analysis		283
<i>B. O'Neill, Y. Ermoliev, T. Ermolieva</i>		
1	Introduction	283
2	Endogenous Climate Change Risk: A General Model	285
3	A Basic Model with Linear Cost Functions	288
4	Extensions to the Basic Model	292
5	A Dynamic Stabilization Problem	296
6	Concluding Remarks	298
	References	299

Pricing Related Projects	301
<i>S. D. Flam,, H. I. Gassmann</i>	
1 Introduction	301
2 Pooling of Single-Stage Linear Problems Subject to Uncertainty ...	303
3 Pricing of Linear Investment Projects.....	306
4 Project Portfolios and Core Solutions	307
5 Stochastic Production Games.....	311
6 Concluding Remarks	311
References	312
Precaution: The Willingness to Accept Costs to Avert Uncertain Danger	315
<i>C. Weiss</i>	
1 Introduction	315
2 Scales of Subjective Uncertainty	316
3 The Precautionary Principle and the Willingness to Incur Costs ...	318
4 A Proposed Principle of Innovation and Adaptive Management ...	322
5 Conclusion: A Framework for Balanced Precaution	324