CONTENTS

Preface	xi
Chapter 1. Uncertain Quantities	1
Second moment representation of a sample of observations	2
Stability of sample averages	5
Second moment representation of a sample of a pair of uncertain	l
quantities	12
Fundamental concepts	16
Chapter 2. The Expectation Model	19
On the positivity of the expectation functional	39
Chapter 3. The Conditional Mean Model	49
The analysis situation	52
The modeling situation	54
The total representation theorem	55
The residual. Geometrical interpretation	57
Generalization	60
Uncertain representations	60

viii CONTENTS

]	Partial conditioning	68
ı	Product sums of uncertain quantities	69
F	Appendix to Illustration 3-2 and Example 3-4	78
Chap	ter 4. Matrix Formulations	84
1	Uncertain linear systems	90
	Uncertain linear systems with uncertain inputs	90
Chap	ter 5. The Linearization Approximations	9
	Compound functions of uncertain quantities	
]	Implicitly given mappings of uncertain quantities	10: 10'
7	The inverse of a regular uncertain matrix	110
Chap	ter 6. Linear Regression	122
7	The analogy between conditional expectation and linear regression	
7	The solution to the linear regression problem	123 123
7	The partial correlation coefficient	13:
Chap	ter 7. Zero-One Uncertain Quantities	138
F	Events and their probabilities	138
	ndependence	141
	Classification	147
I	Discrete uncertainty algebra	151
F	Probability generating functions	153
	The Poisson stream of impulses	155
(Compound discrete uncertainty algebra	159
(Conditional probabilities	165
Chapt	er 8. Distribution Functions	170
E	Density-type distributions	171
	Discrete-type distributions	184
	Density-type uncertainty algebras for pairs of uncertain quantities	185
C	Conditional densities	194
L	Distribution function for an <i>n</i> -set of uncertain quantities	196
	tatistical inference	201
I T	The normal n-dimensional uncertainty algebra	208
1	the bayesian statistical model for inference about normal density	
т	the central-limit theorem. Robustness of tests	214
	Tomas mine theorem. Robustness of lests	221

Chapter 9. The Generalized Reliability Index Concept	226
Comparativeness	230
The generalized reliability index	231
Bounds on the generalized reliability index for systems with several	
modes of failure	236
Geometrical properties of pairs of linear safety margins	237
Examples of reliability index evaluations	240
Observance of partly nonphysical uncertainty sources influencing reliability	244
More than second moment information available	246 248
	240
Chapter 10. Uncertain Processes	252
Positivity of the expectation functional. Nonnegative definite func-	
tions Mean square differentiability	255
Spectral distributions for mean square derivatives	261 272
The indefinite mean square integral	275
The definite mean square integral	277
Linear mappings	289
Nonlinear mappings	293
Linear regression	302
Modeling second moment representations of processes	305
Processes defined by a finite set of uncertain quantities	313
Chapter 11. Some Applicationally Important Special Types of Processes	322
Processes with uncorrelated increments	322
Processes with uncorrelated stationary increments	327
Markov processes	338
Chapter 12. Generalizations: Uncertain Fields and Vector Processes. Markov Vector Processes and Auto-regressive Processes	254
	356
Homogeneous uncertain fields	356
Stationary vector processes and spectral distribution matrices	360
Linear mappings of vector processes Markov vector processes	363 369
The autoregressive vector process	371
Higher-order autoregressive processes	377

X CONTENTS

Chapter 13. Appendix. The Uncertainty Field Concept and Probability		
Theory	385	
Equivalence proof	386	
The uncertain quantities $\lim \inf (X_n)$ and $\lim \sup (X_n)$	390	
Theorems about measurable uncertain quantities	394	
Mean square convergence	398	
Essential convergence in observation	401	
References for Further Reading		
Author index	405	
Subject index	407	
Illustration index	412	