Table of contents

ROLE OF THE THEORY OF STOCHASTIC PROCESSES

 Statistical physics 1

 Stochastic models for population growth

 Ø

 Communication and control

 Ø

 Management

 science

 Ø

 Time series analysis

RANDOM VARIABLES AND STOCHASTIC PROCESSES

1-1 Random variables and probability laws 8
1-2 Describing the probability law of a stochastic process 23
1-3 The Wiener process and the Poisson process 26
1-4 Two-valued processes 35

2 CONDITIONAL PROBABILITY AND CONDITIONAL EXPECTATION

2-1 Conditioning by a discrete random variable 42
2-2 Conditioning by a continuous random variable 61
2-3 Properties of conditional expectation 62

9 NORMAL PROCESSES AND COVARIANCE STATIONARY PROCESSES

3–1 The mean value function and covariance kernel of a stochastid process 66

- **3–2** Stationary and evolutionary processes 69
- 3-3 Integration and differentiation of stochastic processes
- 3-4 Normal processes 88
- 3-5 Normal processes as limits of stochastic processes
- 3-6 Harmonic analysis of stochastic processes 103

4 COUNTING PROCESSES AND POISSON PROCESSES

- 4-1 Axiomatic derivations of the Poisson process 118
- 4-2 Non-homogeneous, generalized, and compound Poisson processes 124
- 4-3 Inter-arrival times and waiting times 132
- 4-4 The uniform distribution of waiting times of a Poisson process 139
- **4–5** Filtered Poisson processes 144

RENEWAL

5 COUNTING PROCESSES

- 5-1 Examples of renewal counting processes 160
- 5–2 The renewal equation 170
- 5-3 Limit theorems for renewal counting processes 180

6 MARKOV CHAINS DISCRETE PARAMETER

- 6-1 Formal definition of a Markov process 188
- **6–2** Transition probabilities and the Chapman-Kolmogorov equation 193
- 6-3 Decomposition of Markov chains into communicating classes 208
- 6-4 Occupation times and first passage times 211
- 6-5 Recurrent and non-recurrent states and classes 221
- 6-6 First passage and absorption probabilities 226
- 6-7 Mean absorption, first passage, and recurrence times 238
- 6-8 Long-run and stationary distributions 247
- 6-9 Limit theorems for occupation times 265
- 6-10 Limit theorems for transition probabilities of a finite Markov chain 270

Appendix 1 The interchange of limiting processes 273

7 MARKOV CHAINS: CONTINUOUS PARAMETER

7-1 Limit theorems for transition probabilities of a continuous parameter Markov chain 276

97

- 7-2 Birth and death processes and their application to queueing theory 278
- 7-3 Kolmogorov differential equations for the transition probability functions 288
- 7-4 Two-state Markov chains and pure birth processes 293
- 7-5 Non-homogeneous birth and death processes 299

REFERENCES 307

AUTHOR INDEX 314

SUBJECT INDEX 316