

Table of contents

ROLE OF THE THEORY OF STOCHASTIC PROCESSES

Statistical physics	1
Stochastic models for population growth	2
Communication and control	2
Management science	4
Time series analysis	5

1 RANDOM VARIABLES AND STOCHASTIC PROCESSES

1-1	Random variables and probability laws	8
1-2	Describing the probability law of a stochastic process	22
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	51
2-3	Properties of conditional expectation	62

3 NORMAL PROCESSES AND COVARIANCE STATIONARY PROCESSES

3-1	The mean value function and covariance kernel of a stochastic process	66
-----	---	----

3-2 Stationary and evolutionary processes 69
 3-3 Integration and differentiation of stochastic processes 78
 3-4 Normal processes 88
 3-5 Normal processes as limits of stochastic processes 97
 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

**5 RENEWAL
 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: 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

7-2	Birth and death processes and their application to queueing theory	<i>278</i>
7-3	Kolmogorov differential equations for the transition probability functions	<i>288</i>
7-4	Two-state Markov chains and pure birth processes	<i>293</i>
7-5	Non-homogeneous birth and death processes	<i>299</i>
REFERENCES		<i>307</i>
AUTHOR INDEX		<i>314</i>
SUBJECT INDEX		<i>316</i>