Design and Analysis of Simulation Experiments

by

Sergei M. Ermakov
and
Viatcheslav B. Melas

Department of Mathematics and Mechanics,
St Petersburg State University,
St Petersburg, Russia
Contents

Preface vii

CHAPTER 1. METHODS OF DISTRIBUTION AND PROCESS SIMULATION 1
1. The arithmetic modelling of randomness 1
2. Simulation of discrete distributions 8
3. Markov chain simulation 16

CHAPTER 2. DISCRETE MARKOV CHAINS 20
1. Notations and statement of the problem 21
2. Estimation of the functional $J(N)$ 23
3. Functional $J$ estimation 32
4. Investigation of stationary behavior 36
5. Method of rotation sampling 48

CHAPTER 3. PATH BRANCHING TECHNIQUE FOR DISCRETE MARKOV CHAINS 51
1. The branching technique – general outline 51
2. Estimation of a linear functional in the transient regime 52
3. Absorbing chains 59
4. The steady-state investigation 63
5. The optimal design concept 66
6. L-optimum criterion 72
7. D-optimum criterion 75
8. Experimental design for a transient regime and for absorbing chains 80
9. A chain with two states 81
10. Waiting and random walk processes 84
11. The rank lattice chain 96

CHAPTER 4. GENERAL MARKOV CHAINS 106
1. Main definitions and notation 106
2. Functionals $J(N)$ and $J$ estimators 109
3. Linear functional of the stationary distribution estimator 110
4. Branching paths technique 116
5. Comparison of branching and importance sampling techniques 121
CHAPTER 5. GENERAL DESIGN METHODS OF SIMULATION AND REGRESSION EXPERIMENTS

1. Cubature and interpolation formulas in the system simulation theory 139
2. Experimental designs minimizing bias and related problems 144
3. An approach to simulation data compression 155
4. The duality theorem and $E$-optimality 162
5. Optimal experimental design for an exponential regression 167

References 189

Subject Index 195