
Contents

Preface	xi
Introduction	1
1 Stochastic simulation	9
1.1 Introduction	9
1.2 Generation of discrete random quantities	10
1.3 Generation of continuous random quantities	13
1.4 Generation of random vectors and matrices	20
1.5 Resampling methods	23
1.6 Exercises	31
2 Bayesian inference	37
2.1 Introduction	37
2.2 Bayes' theorem	37
2.3 Conjugate distributions	44
2.4 Hierarchical models	54
2.5 Dynamic models	58
2.6 Exercises	63
3 Approximate methods of inference	67
3.1 Introduction	67
3.2 Asymptotic approximations	68
3.3 Approximations by Gaussian quadrature	78
3.4 Monte Carlo integration	81
3.5 Methods based on stochastic simulation	83
3.6 Exercises	88
4 Markov chains	93
4.1 Introduction	93
4.2 Definition and transition probabilities	94
4.3 Decomposition of the state space	98
4.4 Stationary distributions	101
4.5 Limiting theorems	104

4.6	Reversible chains	106
4.7	Continuous state spaces	109
4.8	Simulation of a Markov chain	112
4.9	Data augmentation or substitution sampling	115
4.10	Exercises	116
5	Gibbs sampling	119
5.1	Introduction	119
5.2	Definition and properties	120
5.3	Implementation and optimization	124
5.4	Convergence diagnostics	133
5.5	Applications	145
5.6	Software: BUGS, CODA, gibbsit and itsim	150
5.7	Exercises	155
6	Metropolis-Hastings algorithms	161
6.1	Introduction	161
6.2	Definition and properties	162
6.3	Special cases	166
6.4	Hybrid algorithms	169
6.5	Applications	178
6.6	Exercises	189
7	Further topics in MCMC	193
7.1	Introduction	193
7.2	Model adequacy	193
7.3	Model choice	201
7.4	Convergence acceleration	210
7.5	Exercises	217
	References	221
	Author index	235
	Subject index	239