

Contents

Preface	viii
1 Introduction	1
Introduction. Reliability Planning. Definition of System Reliability. Overall Target and Allocation to Subsystems. Reliability Modelling and Evaluation. Testing and Data Collection. Evaluation of Alternative Designs. Reliability Report. Scope of This Book.	
2 The Preliminaries	7
Introduction. Sample Space. Events. Random Variables. Probability Laws. Expectation. Variance. Covariance. Moments. Coefficients of Skewness and Excess. Transform Methods. Some Special Distributions (Exponential, Normal, Log-normal, Weibull, Gamma). Stochastic Processes. Probability Distributions. Markov Chains. Equilibrium Distribution. Time Specific Behaviour. First Passage Times. Alternative Approach to First Passage Times. Continuous Parameter Markov Chains. Transient Behaviour. Equilibrium Probability Distribution. First Passage Times. Exercises. References.	
3 Frequency and Associated Concepts	63
Introduction. Interstate Transition Rate. The Concept of Frequency. Time Specific Domain. Methods of Calculation. Steady State Domain. Time Specific Probabilities. Steady State Probabilities. Alternative Interpretation of Mean Cycle Time, Mean Duration and Mean Frequency. The Relationship to Average Values. The Concept of Equivalent Transition Rate. References.	
4 System Reliability	89
Introduction. Definition and Description of the System and its Requirements. Failure Modes and Effects Analysis. State Space Approach. Series System. Parallel Systems. Decomposition Using the Conditional Probability Approach. Network Approach. Network Reduction Procedure. Cut Set or Tie Set Methods. Tie Set Manipulation. Cut Set Manipulation. Frequency Calculation Using the Cut Set Approach. Algorithm to Determine Minimal Cut Sets. Exercises. References.	

5 Techniques for Large Systems	132
Introduction. The Problem Areas. Equivalent Transition Rate and Conditions of Mergeability. Components Subject to Fluctuating Environment. State Space Truncation. Sequential Truncation. References.	
6 Reliability Modelling in Non-Markovian Systems	164
Introduction. The Difficulty with Non-Markovian Processes. Method of Supplementary Variables. Semi-Markov Processes. Device of Stages. References.	
7 Simulation	211
Introduction. Basic Procedure. Random Number Generation. Simulation Model. Timing Controls. Random Sampling. Estimating Reliability Measures. Equilibrium Conditions and Sample Size. Variance Reducing Techniques. References.	
8 Conclusions	225
9 Appendices	227
Appendix I	227
Solution of Simultaneous Linear Equations	
Appendix II	230
Shape of the Hazard Rate Function of Two Series Stage Combinations in Parallel	
Appendix III	233
Hazard Rate Shape of Series Stages in Series with a Distinctive Stage	
Appendix IV	234
Series Stages in Series with Two Parallel Stages	
Appendix V	239
Moments of Stage Combinations	
Appendix VI	242
Calculation of the Jacobian Matrix	
Index	245