
Contents

1	Introduction	1
2	Background on Coherent Systems	7
	2.1 Basic Ideas	7
	2.2 The Reliability of a Coherent System	17
3	System Signatures	21
4	Signature-Based Closure, Preservation and Characterization Theorems	37
	4.1 An Application to the IFR Closure Problem	37
	4.2 Preservation Theorems Based on Signature Properties.....	43
	4.3 An Application to Redundancy Comparisons.....	48
	4.4 Signature-Based Characterizations of Relative System Performance	53
5	Further Signature-Based Analysis of System Lifetimes	59
	5.1 An Application to Direct and Indirect Majority Systems.....	59
	5.2 An Application to Consecutive k -out-of- n Systems	62
	5.3 The Limiting Behavior of System Failure Rates and Survival Curves	65
	5.4 Comparing Arbitrary Mixed Systems via Stochastic Precedence	68
6	Applications of Signatures to Network Reliability	75
	6.1 An Introduction to Communication Networks	75
	6.2 A Brief Look at Domination Theory	81
	6.3 The Linkage Between Dominations and Signatures.....	83
7	Applications of Signatures in Reliability Economics	91
	7.1 Prototypical Problems in Reliability Economics	91
	7.2 Optimality Criteria	94

XII Contents

7.3	Characterizing Optimal Systems.....	98
7.4	Estimating the Relevant Characteristics of the Component Distribution	106
7.5	Approximately Optimal System Designs	114
7.6	Discussion	116
8	Summary and Discussion	119
8.1	Introduction	119
8.2	A Retrospective Overview	120
8.3	Desiderata.....	124
8.4	Some Additional Related Literature.....	128
8.5	Some Open Problems of Interest	131
8.5.1	The Ordering of Expected System Lifetimes	131
8.5.2	Other Preservation Results	131
8.5.3	The limiting monotonicity of $r_T(t)$	132
8.5.4	Further Results on Stochastic Precedence.....	132
8.5.5	Uniformly Optimal Networks	133
8.5.6	Other Problems in Reliability Economics	135
8.5.7	Wholly New Stuff	137
	References	139
	Index	145