

Contents

- 1 Introduction.** 1
 - 1.1 Further Studies and Applications 3
 - 1.2 Random Failure Time. 4
 - 1.2.1 Reliability, Failure Rate, and Availability 4
 - 1.2.2 Expected Number of Failures 6
 - 1.2.3 Uniform Distribution 10
 - 1.2.4 Entropy Model 11
 - 1.3 Random Replacement. 12
 - 1.3.1 Random Age Replacement 12
 - 1.3.2 Random Periodic Replacement 13
 - 1.3.3 Random Block Replacement. 14
 - 1.3.4 No Replacement at Failure 15
 - 1.4 Problems 16
 - References 17
- 2 Random Age Replacement Policies** 19
 - 2.1 Random Replacement. 20
 - 2.1.1 Shortage and Excess Costs 22
 - 2.1.2 Comparison of Age and Random Replacement Policies 25
 - 2.2 Random Replacement Policies. 28
 - 2.2.1 Replacement First 28
 - 2.2.2 Replacement Last 32
 - 2.2.3 Replacement Overtime 34
 - 2.2.4 Replacement of Uniform Random Time 36
 - 2.3 Comparisons of Replacement Times. 37
 - 2.3.1 Comparison of Replacement First and Last. 38
 - 2.3.2 Comparisons of Replacement Overtime, First, and Last. 40

2.4	<i>N</i> th Working Time.	42
2.4.1	Replacement First	42
2.4.2	Replacement Last	46
2.4.3	Replacement with Constant Time	49
2.5	Problems	51
	References	51
3	Random Periodic Replacement Policies	53
3.1	Random Replacement.	54
3.1.1	Block Replacement	58
3.2	Random Periodic Replacement	64
3.2.1	Four Replacement Policies	64
3.2.2	Comparisons of Optimum Policies.	68
3.2.3	Comparisons of Policies with Different Replacement Costs	72
3.3	<i>N</i> th Working Time.	75
3.3.1	Replacement First	75
3.3.2	Replacement Last	79
3.3.3	Replacement Overtime.	81
3.3.4	Replacement with Constant Time	82
3.4	Problems	84
	References	85
4	Random Inspection Policies	87
4.1	Periodic and Random Inspections.	88
4.1.1	Sequential Inspection	93
4.1.2	Comparison of Periodic and Random Inspections	95
4.2	Random Inspection	98
4.3	Modified Random Inspection Policies.	101
4.3.1	Inspection First	101
4.3.2	Inspection Last	104
4.3.3	Comparison of Inspection First and Last	107
4.3.4	Inspection Overtime.	108
4.4	Finite Interval	112
4.5	Problems	113
	References	114
5	Random Backup Policies	115
5.1	Periodic and Random Backup Times	116
5.2	Optimum Checking Time	121
5.3	Random Backup	123
5.3.1	<i>N</i> Works	123
5.3.2	6 Works.	126

5.4	Random Backup for Continuous Model	128
5.5	Checkpoint Models with Random Works	131
5.5.1	Three Schemes with Two Types of Checkpoints	132
5.5.2	Comparison of Three Schemes	135
5.5.3	Comparison of Four Works	136
5.6	Problems	138
	References	139
6	Random Parallel Systems	141
6.1	MTTF of a Parallel System	142
6.1.1	Asymptotic Methods	143
6.1.2	Random Number of Units	146
6.2	Number of Units and Replacement Time	148
6.2.1	Optimum Number of Units	148
6.2.2	Optimum Replacement Time	151
6.3	K -out-of- n System	155
6.3.1	Constant K	155
6.3.2	Random K	158
6.4	Shortage and Excess Costs	162
6.4.1	Age Replacement	163
6.4.2	Random Replacement	165
6.4.3	Random Number of Units	167
6.4.4	N th Random Replacementt	170
6.5	Problems	173
	References	173
7	Random Scheduling	175
7.1	Scheduling of Random Works	176
7.1.1	Single Work	176
7.1.2	N Tandem Works	180
7.1.3	N Parallel Works.	182
7.2	Redundant Systems	184
7.2.1	Standby System	184
7.2.2	Parallel System	186
7.3	Random Number of Works	188
7.3.1	N Tandem Works	188
7.3.2	N Parallel Works.	190
7.3.3	Standby System	192
7.3.4	Parallel System	194
7.4	Problems	195
	References	196

8 Other Random Maintenance Models	197
8.1 Random Finite Interval	198
8.1.1 Inspection Policies	198
8.1.2 Replacement with Minimal Repair	202
8.1.3 Imperfect PM	206
8.1.4 Random Interval with Discount Rate	207
8.2 Random Interval Reliability	209
8.2.1 Random Time	211
8.3 Cumulative Damage Model with Random Failure Level	213
8.3.1 Replacement Policy	213
8.3.2 Periodic Replacement	217
8.3.3 Continuous Damage Model	219
8.4 Other Random Reliability Models	221
8.4.1 Random Scheduling Time	221
8.4.2 Random Inspection Number	222
8.4.3 Random Number of Failures	223
8.5 Problems	225
References	225
Appendix A: Extended Failure Rates	227
Appendix B: Answers to Selected Problems	241
Index	263



<http://www.springer.com/978-1-4471-6574-3>

Random Maintenance Policies

Nakagawa, T.

2014, X, 264 p. 19 illus., Hardcover

ISBN: 978-1-4471-6574-3