Index

(N, T)-policy, 12

A
Accelerated ageing process, 194
Accelerated burn-in, 179
Accelerated environment, 179
Accelerated failure time, 193
Accelerated life, 52
Accelerated life test, 193
Actual age, 22
Additional warranty, 34
Adjustment factor, 120
Age, 6
Age replacement, 3
Age-based, 252
Age-correcting factor, 43
Age-dependent, 49
Age-reducing repair, 43
Aging process, 81
Allowable inventory time, 69
Alternating renewal process, 7
Arrival rate, 56
As good-as-new, 28
As-bad-as-old, 41
Availability, 28

B
Baldi–Chauvin algorithm, 210
Bathtub, 28
Bathtub-shape, 192
Baum–Welch algorithm, 210
Bayes' Theorem, 214
Bayesian analysis, 51
Better-than-perfect maintenance, 129
Bivariate imperfect repair, 41
Block replacement, 3
Breakdown, 6
Burn-in, 26
Burn-in cost, 27
Burn-in time, 26

C
Carrying cost, 17
Catastrophic failure, 16
Complete overhaul, 118
Complete repair, 26
Component, 4
Condition based maintenance, 129
Constant Probability Model, 189
Continuous discounting, 50
Coordinated group replacement, 86
Corrective maintenance, 3
Corrective replacement, 17
Cost effectiveness, 71
Cost function, 3
Cost variability, 8
Counting process, 86
Covariate, 225
Critical component, 112
Cumulative hazard rate, 15
Customer support, 225
Cycle, 4

D
Damage, 91
Defective, 22
Degradation, 8
Degree of deterioration, 30
Degree of repair, 207
Delayed corrective replacement, 17
Delayed preventive replacement, 17
Demand rate, 20
Dependability, 231
Dependability characteristics, 225
Dependent failure mode, 115
Descriptive models, 4
Deteriorating system, 60
Deterioration, 5
Discounted cost, 24
Discounting factor, 30
Discrete discounting, 57
Doob decomposition, 212
Downtime cost, 32
Dynamic programming, 210
Dynamic repair cost limit, 14

Economic Order Quantity, 16
Economic Production Quantity, 16
Effective age, 119
Efficiency, 230
Environmental Stress Screening, 201
Estimation, 210
Expectation–maximization algorithm, 207
Expected cost rate, 13
Expedited order, 56
Exponential, 255
External failure, 47

Failed component, 4
Failure, 4
Failure cost, 61
Failure mode, 115, 117, 119, 121, 123, 125
Failure prediction, 235
Failure process, 102
Failure rate, 5
Failure rate reduction, 136
Failure search, 81
Failure time, 6
Failure time distribution, 11
Failure type, 5
Filter recursion, 217
Filtering, 207, 209, 211, 213, 215, 217, 219, 221
Finite horizon, 87

Foreword, vii
Forward algorithm, 210
Forward–backward algorithm, 210
Fubini’s theorem, 106

General failure, 185
General renewal process, 53
General repair, 42
Geometric process, 60
Great deluge, 51
Group maintenance, 83

Hazard rate, 12
Hidden failure, 132
Hidden Markov model, 207
Holding cost, 20
Hybrid parameter, 134
Hypothesis, 207

Imperfect inspection, 15
Imperfect maintenance, 5
Imperfect production, 20
Imperfect repair, 5
Improvement factor, 42
Improving system, 40
In-control, 74
Incomplete-data, 52
Independent failure mode, 115
Information-based model, 101–102, 105, 107, 109, 111, 113
Inspection, 4
Inspection cost, 15
Inspection error, 21
Inspection frequency, 75
Inspection interval, 21
Inspection time, 74
Instantaneous repair, 104
Integer programming, 22
Integrable counting process
Integrated model, 20
Intensity rate, 23
Internal failure, 47
Inventory, 16
Inventory control, 16
Inverse linear, 256
Index

**J**
Job shop, 21

**K**
Kijima model, 219
Kolmogorov Extension Theorem, 213

**L**
Lack of perfection factor, 42
Lead-time, 16
Learning, 47
Lease contract, 46
Lease period, 46
Leased equipment, 46
Lebesgue measure, 189
Life cycle, 30
Lifetime, 7
Likelihood function, 53
Line Repairable Unit, 260
Linear, 255
Linear model, 137
Location adjustment parameter, 134
Logistics, 226
Lot-size, 19

**M**
M-ary detection, 207, 209, 211, 213, 215, 217, 219, 221
Maintainability, 232
Maintainable failure, 80
Maintenance, 4
Maintenance opportunities, 45
Maintenance period, 30
Major breakdown, 15
Major failure, 53
Major overhaul, 6
Major repair, 20
Management, 225
Management risk, 9
Markov, 39
Markov chain, 51, 83
Markov decision process, 109
Markovian arrival process, 47
Martingale, 210
Mathematical programming, 50
Maximum likelihood estimate, 52
Measure, 212
Minimal maintenance, 130
Minimal repair, 3
Minimal repair process, 104
Minor failure, 16
Minor maintenance, 5
Minor overhaul, 6
Monotone process, 8
Monotone system, 102
Monte Carlo simulation, 52
Multi-component, 47
Multi-unit, 47

**N**
N-policy, 12
New, 4
Non-homogeneous Poisson process, 3
Non-maintainable failure, 80
Non-parametric, 24
Non-renewing warranty, 28
Non-repairable, 181
Non-stationary, 29
Nonlinear model, 137
Normal distribution, 1449

**O**
Objective function, 10
Operating cost, 20
Operational cost, 8
Opportunity-based replacement, 44
Optimal design, 85
Optimal ordering policy, 23
Optimal period, 143
Optimal replacement times, 3
Optimization, 4
Ordering cost, 16
Out-of-control, 74
Out-of-warranty replacement, 32
Outsourcing, 47
Overhaul, 5

**P**
Parameter of rejuvenation, 42
Parameter updating, 214
Part Stress Analysis, 238
Partial likelihood, 255
Parts Count, 238
Perfect maintenance, 129
Perfect repair, 7
Performance indicator, 129
Periodic overhaul, 80
Periodic replacement, 6
Phase-type distribution, 47
P (cont.)
Planned maintenance, 5
Planned replacement, 23
Point process, 7
Poisson failures, 39
Poisson process, 245
Policy, 5
Post warranty cost, 49
Posterior probability, 210
Predictable, 212
Predictor, 51
Prescriptive models, 4
Preventive maintenance, 5
Preventive replacement, 17
Preventive replacement cost, 20
Prior distribution, 51
Production, 18
Production rate, 20
Production resumption cost, 20
Production scheduling, 22
Profit, 56
Proportional hazard, 52
Purchasing cost, 34

Q
Quasi-renewal process, 136

R
Random, 5
Random delivery time, 18
Random failure, 207
Random repair cost, 15
Rebate, 34
Reference probability, 213
Region, 163
Regression, 237
Regular order, 56
Reliability, 4
Reliability based design, 82
Reliability centered maintenance, 131
Reliability engineering, 115
Reliability prediction, 237
Renewal cycle, 35
Renewal function, 31
Renewal interval, 8
Renewal point, 54
Renewal process, 7
Renewal reward, 8
Renewing warranty, 28
Repair, 4
Repair cost, 14
Repair cost limit, 14
Repair services, 225
Repair time, 19
Repairable system
Replacement, 3
Replacement cost, 12
Replacement cycle, 8
Replacement period, 15
Residual life, 30
Residual warranty period, 30
Residual warranty time, 4
Restoration, 42
Restoration factor, 135
Restoration interval, 57
Revenue, 129
Risk based maintenance, 129
Risk factor, 241
Risk neutral, 34

S
Safety, 230
Safety critical, 44
Safety probability limit, 44
Salvage value, 72
Scale adjustment parameter, 134
Scale parameter, 166
Schedule, 5
Scheduled maintenance, 5
Scheduled replacement, 17
Semimartingale decomposition, 212
Separation Theorem, 210
Sequential hypothesis testing, 210
Sequential policy, 90
Servicing cost, 30
Servicing strategy, 163
Set-up cost, 21
Shape parameter, 172
Shock, 23
Shortage, 22
Shortage cost, 22
Shut down, 23
Sloppy repair, 208
Smooed perturbation analysis, 52
Sojourn time, 216
Spare part, 225–226, 228, 231, 233–234, 236, 241, 244, 246, 250, 252, 254, 257, 259, 262, 264, 266–267, 269
Standard warranty, 29
<table>
<thead>
<tr>
<th>Index</th>
<th>275</th>
</tr>
</thead>
<tbody>
<tr>
<td>State process, 108</td>
<td></td>
</tr>
<tr>
<td>Stationary, 29</td>
<td></td>
</tr>
<tr>
<td>Stochastic process, 207</td>
<td></td>
</tr>
<tr>
<td>Stopping time, 104</td>
<td></td>
</tr>
<tr>
<td>Strategy, 31</td>
<td></td>
</tr>
<tr>
<td>Stress-strength, 238</td>
<td></td>
</tr>
<tr>
<td>Sub-region, 168</td>
<td></td>
</tr>
<tr>
<td>Subsidiary failures, 82</td>
<td></td>
</tr>
<tr>
<td>Supportability, 227</td>
<td></td>
</tr>
<tr>
<td>Survival period, 31</td>
<td></td>
</tr>
<tr>
<td>System down, 19</td>
<td></td>
</tr>
<tr>
<td>System downtime, 25</td>
<td></td>
</tr>
<tr>
<td>System failure, 7</td>
<td></td>
</tr>
<tr>
<td>T-policy, 12</td>
<td></td>
</tr>
<tr>
<td>Temporal pattern recognition, 210</td>
<td></td>
</tr>
<tr>
<td>Time horizon, 11</td>
<td></td>
</tr>
<tr>
<td>Time to failure, 14</td>
<td></td>
</tr>
<tr>
<td>Top-down methodology, 129</td>
<td></td>
</tr>
<tr>
<td>Total productive maintenance, 129</td>
<td></td>
</tr>
<tr>
<td>Transition probability matrix, 211</td>
<td></td>
</tr>
<tr>
<td>Two-dimensional, 8</td>
<td></td>
</tr>
<tr>
<td>Two-dimensional warranty, 37</td>
<td></td>
</tr>
<tr>
<td>Two-phase maintenance, 83</td>
<td></td>
</tr>
<tr>
<td>Two-phase warranty, 31</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td></td>
</tr>
<tr>
<td>Unplanned replacement, 24</td>
<td></td>
</tr>
<tr>
<td>Unplanned stoppage, 225</td>
<td></td>
</tr>
<tr>
<td>Unreliable, 56</td>
<td></td>
</tr>
<tr>
<td>Upper bound, 14</td>
<td></td>
</tr>
<tr>
<td>Upper record, 52</td>
<td></td>
</tr>
<tr>
<td>Usage rate, 164</td>
<td></td>
</tr>
<tr>
<td>Used, 4</td>
<td></td>
</tr>
<tr>
<td>Utility, 34</td>
<td></td>
</tr>
<tr>
<td>Utilization, 226</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Virtual age, 42</td>
<td></td>
</tr>
<tr>
<td>Virtual age process, 42</td>
<td></td>
</tr>
<tr>
<td>Viterbi algorithm, 210</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td></td>
</tr>
<tr>
<td>Warranted, 28</td>
<td></td>
</tr>
<tr>
<td>Warranty, 28</td>
<td></td>
</tr>
<tr>
<td>Warranty cost, 30</td>
<td></td>
</tr>
<tr>
<td>Warranty expiration, 30</td>
<td></td>
</tr>
<tr>
<td>Warranty period, 28</td>
<td></td>
</tr>
<tr>
<td>Warranty reserve, 30</td>
<td></td>
</tr>
<tr>
<td>Wear-out, 141</td>
<td></td>
</tr>
<tr>
<td>Weibull, 261</td>
<td></td>
</tr>
</tbody>
</table>