

Contents

Foreword	xi
Preface	xiii
Acronyms	xv
1 Introduction	1
2 Risk Assessment	9
2.1 Introduction	9
2.2 Fire Risk Assessment	12
2.2.1 Qualitative Fire Risk Assessment	14
2.2.2 Quantitative Fire Risk Assessment	17
3 Monte Carlo Simulations	25
3.1 Introduction	25
3.2 Mathematical Formulation of the Simple Monte Carlo	27
3.3 Error Estimation of the Simple Monte Carlo	32
3.4 Estimating Probabilities with the Simple Monte Carlo	34
3.5 Estimating Quantiles with the Simple Monte Carlo	36
3.6 Speeding up the Convergence of the Monte Carlo	38
4 Introductory Survey of Decision Theory	47
4.1 Introduction	47
4.2 Normative Decision Theory	49
4.2.1 Decision Matrices	51
4.2.2 Decision Making under Ignorance	53
4.2.3 Decision Making under Uncertainty	57
4.2.4 Decision Making under Risk or Certainty	62
4.3 Descriptive Decision Theory	63
4.4 Statistical Decision Theory	65
4.5 Decisions Sensitivity Analysis	67

5	Multisimulation	73
5.1	Introduction to Multisimulation	73
5.2	Multisimulation Process	76
5.3	Output Parameters	80
5.4	Risk representation	84
5.4.1	Event trees	84
5.4.2	Complement Cumulative Distribution Function	88
5.5	Estimation of Model Uncertainty	91
6	Aamks Software	95
6.1	Introduction	95
6.2	Geometry Processor	96
6.3	Monte Carlo Module	97
6.4	Fire Simulator	98
6.5	Evacuator	99
6.6	User Interface Module	99
6.7	Results Module	101
6.8	Grid Manager	102
6.9	Installer	102
7	Stochastic Fire Modeling	105
7.1	CFAST – Two-Zone Fire Model	106
7.2	Stochastic Fire Modeling Based on Two-Zone Fire Model	109
7.3	Model Uncertainty	112
8	Stochastic Evacuation Modeling	115
8.1	Introduction	115
8.2	Geometry of the Environment	116
8.3	Path-finding	117
8.4	Local Movements	120
8.5	Evacuation under Fire and Smoke	128
8.6	Stochastic Modeling	129
8.7	Quality and the Performance of A-evac	130
9	Stochastic Fire and Rescue Service Intervention	135
9.1	Introduction	135
9.2	FRS Activities at the Emergency Scene	137
9.3	Stochastic FRS Intervention Model	139
10	Data Acquisition for Probabilistic Risk Assessment	141
10.1	Introduction	141

11 Risk Ranking	149
11.1 Introduction	149
11.2 SFPE Risk Matrix	150
11.3 Derivation of Societal Acceptable Risk Level	152
11.4 Comparative Analysis	153
11.5 Decision Theory	153
11.6 Cost-Effectiveness of Life-Saving Interventions	156
12 Case Study – a Hotel Building	159
12.1 Alternatives of a Fire Safety Concept	160
12.2 Risk Calculation	163
12.3 Risk Ranking	169
12.3.1 Absolute Criteria Regarding PD 7974-7	170
12.3.2 SFPE Risk Ranking Matrix	171
12.3.3 Derivation of Acceptable Risk Level	171
12.3.4 Statistical Decision Theory	172
12.3.5 Comparative Study	173
12.3.6 Cost-Effectiveness of Life-Saved Interventions	174
12.4 Discussion	175
13 Summary	177
List of Figures	181
List of Tables	184
References	187