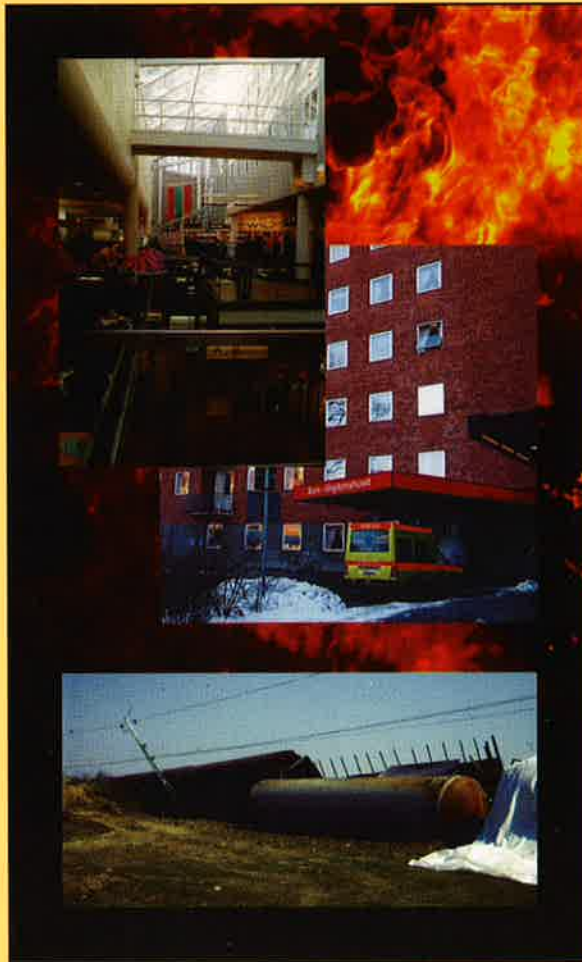




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Uncertainty and Risk Analysis in Fire Safety Engineering



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Contents

Nomenclature	v
1 Introduction	1
1.1 Background	1
1.2 Purpose of the study	5
1.3 Risk management	6
1.3.1 Qualitative methods	7
1.3.2 Semi-quantitative methods	8
1.3.3 Quantitative methods	9
1.4 Uncertainty	11
1.5 Overview of this thesis	11
1.6 Limitations	13
2 Sources of failure	15
2.1 Error classification	15
2.2 Gross errors	16
2.2.1 Human error	16
2.3 Random variability	17
2.3.1 Uncertainty caused by randomness	18
2.4 Handling gross errors	20
2.5 Systematic errors	20
2.6 Uncertainty in subscenarios	21
3 Logical systems	23
3.1 Event tree	23
3.2 Fault tree	26
3.3 Problems with logical trees	28
4 The unwanted consequences	31
4.1 Model for consequence calculation	31
4.1.1 The limit state function	31
4.1.2 Untenable conditions	33
4.1.3 The values of variables	36

4.2	Sensitivity analysis	38
4.3	System analysis	38
4.4	Response surface method	40
4.5	Creating the response surface equation	42
4.5.1	The linear two-dimensional case	42
4.5.2	Nonlinear problems	46
4.5.3	Design of experiments	48
5	Describing random variables	51
5.1	Statistical distributions	51
5.2	Correlated variables	53
5.3	The choice of distribution	53
5.3.1	The classical approach	54
5.3.2	The Bayesian approach	55
5.3.3	Bayes' theorem	56
5.4	Fire safety engineering data	59
5.5	Distributions used in fire safety engineering	60
6	Quantitative methods	63
6.1	Introduction	63
6.2	Performing a QRA	66
6.3	Risk measures	68
6.3.1	Individual risk	69
6.3.2	Societal risk	69
6.4	Standard quantitative risk analysis	70
6.4.1	Societal risk	71
6.4.2	Individual risk	74
6.4.3	Limitations	76
6.5	Uncertainty analysis	77
6.6	The single subscenario	79
6.6.1	The analytical reliability index β method	80
6.6.2	Reliability index β method with multiple failure modes	88
6.6.3	Numerical sampling methods	91
6.6.4	Importance of variables	97

6.7	Extended quantitative risk analysis	100
6.7.1	Societal risk	100
6.7.2	Individual risk	106
6.7.3	Application of the method	107
7	Sample risk analysis of a hospital ward	109
7.1	Introduction	109
7.2	Definition of the system	110
7.3	Standard QRA	113
7.3.1	Societal risk	113
7.3.2	Individual risk	117
7.4	Extended QRA	117
7.4.1	Societal risk	117
7.4.2	Individual risk	127
7.5	Uncertainty analysis of individual subscenarios	128
7.5.1	The analytical reliability index β method	129
7.5.2	Numerical sampling methods	134
7.6	Concluding remarks	140
8	Risk evaluation	143
8.1	Tolerable risk	143
8.2	Risk measures	144
8.3	Uncertainty in QRA	146
9	Design values based on risk	149
9.1	Introduction	149
9.2	Theory of the method	150
9.3	The design problem	151
9.4	Method	153
9.5	Design values	159
9.6	Problems with the method	162
10	Summary, conclusions and future work	165

Acknowledgements 169

References 171

Appendix A "Description of Matlab files"

Appendix B "General assumptions for the sample scenario"

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Keywords: Risk analysis, uncertainty analysis, Monte Carlo simulation, FOSM, reliability index, fire engineering design, event tree, response surface.

Abstract: Two Quantitative Risk Analysis (QRA) methods are presented which can be used to quantify the risk to occupants in, for example, a building in which a fire has broken out. The extended QRA considers the inherent uncertainty in the variables explicitly. The standard QRA does not consider the uncertainties in the variables and must be complemented by a sensitivity analysis or an uncertainty analysis. Both methods provide risk measures, such as individual risk and FN curves. In the extended QRA these are presented in terms of statistical distributions. The standard QRA is more simple to perform and has been used extensively in many engineering fields. Both QRA methods have been applied to an example, structured with the event tree technique, to determine the risk to patients on a hospital ward.

In addition to the two risk analysis methods, separate uncertainty analysis methods are also presented. Both stochastic uncertainty and knowledge uncertainty are considered in the analysis, separately and combined. The importance of the variables is also investigated.

As both QRA methods are rather complex to use, a more simple method using design values in deterministic equations would be preferable for fire safety design purposes. A method of deriving these design values, based on quantified risk, is presented and complemented with an example which provides design values for a class of buildings. When these design values are known, so-called partial coefficients can be derived.

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Front page photo: Typical societal risks (hospital, shopping centre and transportation of hazardous goods). S-I Granemark and H Frantzich.

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