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Risk and Reliability Analysis: Theory and Applications

In Honor of Prof. Armen Der Kiureghian

 Springer

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*This book is dedicated to Professor Armen
Der Kiureghian*

Preface

Communities face a number of risks from natural and anthropogenic hazards. Risk and reliability analysis provide essential information for risk determination (the quantification of the probabilities of potential consequences in various hazardous scenarios), evaluation (the decision of whether actions are necessary, under conditions of uncertainty), and mitigation (the decision of how to act).

Over the past few decades, risk and reliability analysis have gone from a specialty topic to a mainstream subject in engineering, becoming essential tools for informed decision-making, hazard mitigation and planning. This book presents the state of the art in risk and reliability with a unique collection of contributions from some of the foremost scholars in the field. Combining the most advanced analysis techniques with practical applications, this book is one of the most comprehensive and up-to-date references available on this subject, makes the state of the art in risk and reliability analysis accessible to a large audience, and helps make risk and reliability analysis the rigorous foundation of engineering decision-making. The fundamental concepts needed to conduct risk and reliability assessments are covered in detail, providing readers with a sound understanding of the field and making the book a powerful tool for students and researchers alike.

The book is a tribute to one of the fathers of modern risk and reliability analysis, Prof. Armen Der Kiureghian. During his career, Prof. Der Kiureghian has made fundamental and revolutionary research contributions. He has pioneered methods for safety and reliability assessment of complex structures and for stochastic seismic analysis of buildings, bridges and critical equipment. He has more than 300 publications, including more than 100 journal articles and book chapters. Many of his publications have become mandatory reading for the current and future generations of students, researchers and practitioners.

The book is organized into six parts. Part I gives a general introduction of the book including a discussion of its goal and contributions, presents an overview of the field of risk and reliability analysis, and discusses the role of Armen Der Kiureghian in modern risk and reliability analysis. Part II focuses specifically on reliability analysis, and includes a description of computational methods and applications to some of the most complex real-life problems. Part III covers the

subject of stochastic dynamics. As in Part II, Part III also includes both theoretical formulations and applications. Part IV discusses methods for sensitivity analysis and optimization in the context of risk and reliability analysis. Part V focuses on statistical analysis and the development of probabilistic models. Finally, Part VI covers life-cycle and resilience analysis as well as financial tools for risk mitigation. While each part has a specific and distinct focus, many of the chapters draw from methods and techniques covered in some of the other parts of the book. Such links among chapters help understand the relations among the different subjects.

Urbana, IL, USA

Paolo Gardoni



Armen Der Kiureghian

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