Preface

"When one admits that nothing is certain one must, I think, also admit that some things are much more nearly certain than others."

Bertrand Russell, Am I An Atheist Or An Agnostic?

The development of useful and relevant methods for assessing and managing structures has become an important challenge today. The economic, societal, and environmental stakes attached to this development are a growing concern for public or private owners and stakeholders. The need for relevant and efficient approaches, taking into account the uncertainties to do with loading, geometry, material properties, design and construction, and their operating conditions, is widely felt. The reliability theory, which is based on a probabilistic formulation of structural performances, conceptually answers these questions, in an adapted way. Nevertheless, it often raises difficulties, on the theoretical front as well as the numerical and practical front. However, the theory provides an original alternative for requalifying structures.

This book has been designed to provide students, engineers, and researchers with a panorama of methods in order to implement a probabilistic approach to structural performance in their respective frameworks. This book is the product of much teaching in engineering schools, or in continuing education. Also, it presents different concepts by giving examples which, mostly, can be carried out *by hand*. Based on measuring the possible on concrete examples, these concepts try both to illustrate theoretical approaches and to demonstrate their interest and practical implementation. This book is then, neither a textbook on reliability theory, nor a technical set of guidelines for assessing structure's performances. It is something in between, passing through the field of theoretical concepts, as well as exploring practical problems found in structural assessments.

This book is divided into six chapters. The reader may be surprised to find a long chapter (Chapter 1), referring back to probabilities and statistics. This cannot be overlooked as the reader needs to have a minimum theoretical knowledge in this domain, in order to approach the following chapters peacefully. Chapter 2 presents a whole series of concepts on hazards and performances. It summarizes the basic concepts used in the other chapters. Chapters 1 and 2 form the backbone of this book, with the other chapters develop or branching off from previously presented concepts. Chapter 3 introduces the concepts of reliability theory. It does not try to present its theoretical elements as exhaustively as possible, but to highlight its practical implementation. It is, then, intended for students, engineers and researchers, who – across the range of problems that they are studying – want to translate their studied problems into the principles of reliability theory. Chapter 4 defines performance ratings, and their practical implementation. To a certain extent, it draws the link between probabilistic concepts and the reliability theory of structures, as well as the problems of structural assessment. As this type of study requires a probabilistic description of variables, Chapter 5 therefore proposes various models and data, allowing an *a priori* performance study that could be updated as soon as knowledge is gradually improved. The book ends on a chapter (Chapter 6) devoted to decision theory. A series of concepts for maintenance and inspection are presented within this chapter, along with their contribution, their integration into performance assessment and their help for the management of structures.

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