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| Nota di contenuto       | Title Page; Contents; Preface; CHAPTER 1. UNCERTAINTY; 1.1. Introduction; 1.2. The optimization problem; 1.3. Sources of uncertainty; 1.4. Dealing with uncertainty; 1.4.1. Reliability optimization; 1.4.2. Robust optimization; 1.4.3. Multi-object optimization; 1.4.4. Stochastic optimization; 1.4.5. Worst-case scenario based optimization; 1.4.6. Non-probabilistic optimization; 1.4.7. Interval modeling; 1.4.8. Fuzzy sets; 1.5. Analyzing sensitivity; 1.5.1. Local sensitivity analysis; 1.5.2. Global sensitivity analysis; CHAPTER 2. RELIABILITY IN MECHANICAL SYSTEMS; 2.1. Introduction 2.2. A structure reliability problem; 2.3. Modeling a structure reliability problem; 2.3.1. A deterministic mechanical model; 2.3.2. Risks and probabilistic modeling; 2.3.3. Types of failure in a structure; 2.3.4. Probability of failure in a structure; 2.4. Calculating the probability of failure in a structure; 2.4.1. Calculating the probability of failure using the Monte Carlo method; 2.4.2. Calculating the probability of failure using a reliability index; 2.5. Reliability indices; 2.5.1. The Rjanitzyne-Cornell index; 2.5.2. The Hasofer-Lind index; 2.5.3. The FORM method |

2.5.4. The SORM method; 2.6. Overview of the resistance-sollicitation problem; 2.6.1. Probability of failure; 2.6.2. Reliability indices; 2.7. System reliability in mechanics; 2.7.1. Combinations of types of failure; 2.7.2. Assessment of the failure probability of a system; 2.8. The finite element method and structural reliability; 2.8.1. Context and objectives of the problem; 2.8.2. Discretization and modeling random fields; 2.8.3. Mechano-reliability coupling; 2.8.4. Surface response coupling; CHAPTER 3. OPTIMAL STRUCTURAL DESIGN; 3.1. Introduction 3.2. Historical development of structural optimization; 3.3. Classifying structural optimization problems; 3.3.1. Dimensional optimization; 3.3.2. Topological optimization; 3.3.3. Shape optimization; CHAPTER 4. MULTI-OBJECT OPTIMIZATION WITH UNCERTAINTY; 4.1. Introduction; 4.1.1. Choice of an optimization method; 4.1.2. Classifying optimization methods; 4.2. User classification; 4.3. Design classification; 4.4. Multi-objective genetic algorithms; 4.5. Robust multi-objective optimization; 4.5.1. Robustness criteria in multi-objective optimization; 4.6. Normal boundary intersection method 4.6.1. Description of the NBI method; 4.7. Multi-objective structural optimization problem; CHAPTER 5. ROBUST OPTIMIZATION; 5.1. Introduction; 5.2. Modeling uncertainty; 5.2.1. Parametric methods; 5.2.2. Non-parametric methods; 5.3. Accounting for robustness in optimum research; 5.4. Robustness criteria; 5.4.1. Defining uncertainty in design parameters; 5.4.2. Robustness criteria in multi-objective optimization; 5.5. Resolution method; 5.6. Examples of mono-objective optimization; CHAPTER 6. RELIABILITY OPTIMIZATION; 6.1. Introduction; 6.2. Overview of reliability optimization; 6.3. Reliability optimization methods

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## Sommario/riassunto

Optimization is generally a reduction operation of a definite quantity. This process naturally takes place in our environment and through our activities. For example, many natural systems evolve, in order to minimize their potential energy. Modeling these phenomena then largely relies on our capacity to artificially reproduce these processes. In parallel, optimization problems have quickly emerged from human activities, notably from economic concerns. This book includes the most recent ideas coming from research and industry in the field of optimization, reliability and the recognition of a

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