OPTIMIZATION OF MECHANICAL SYSTEMS

Fundamentals and algorithms

M.EM005

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Preface

Optimization is a branch of the field of mathematics and numerical methods that has been the subject of theoretical and applied research over the last decades. In particular, engineering is one of the areas where optimization has found fertile ground for its application and theoretical and practical development. Optimization techniques have reached an unprecedented maturity and are used in a wide spectrum of industrial applications in different areas, namely structural engineering, aerospace, automotive, chemical, electronics, computer-aided manufacturing and industrial production.

Optimisation can be defined as the rational establishment of a design that is the best within all possible ones according to one or more predefined objectives and obeying a prescribed set of constraints. In a broad sense, the mentioned conditions require an adequate integration between two well-defined areas: engineering optimization and mathematical optimization. This interaction results in the integration of optimisation in the design cycle of engineering systems.

In order to apply mathematical concepts to the search for optimal design of engineering systems, the underlying mathematical problem must be formulated and its model built. To do so, it is necessary to define the design variables, the objectives and the constraints of the optimisation problem. In this book, a detailed presentation of the mathematical concepts of optimization is given as well as a description of the main algorithms according to their taxonomy.

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