

# Preface

Optimization is an area of critical importance in engineering and applied sciences. When designing products, materials, factories, production processes, manufacturing or service systems, and financial products, engineers strive for the best possible solutions, the most economical use of limited resources, and the greatest efficiency. As system complexity increases, these goals mandate the use of state-of-the-art optimization methodology and computational tools.

The theory and computational methodology of optimization have seen revolutionary improvements in the past three decades. Novel algorithmic concepts and high-performance modeling methodologies have been developed. Moreover, the exponential growth in computational power along with the availability of multicore computing with virtually unlimited memory and storage capacity has fundamentally changed what engineers can do to optimize their designs.

This is a two-way process: engineers benefit from developments in optimization methodology, and challenging new classes of optimization problems arise from engineering applications.

This handbook reviews the major areas of optimization and provides a sampling of their engineering applications. It is organized into 10 parts, encompassing both well-established areas and emerging trends that are significant for engineering. There are four chapters in each part, where the first chapter provides an overview of the state of the art, and the subsequent three present illustrative applications.

Due to its broad coverage, we anticipate that the readership of this handbook will span large portions of the engineering, optimization, and operations research communities, from doctoral students to experienced researchers. In particular, this handbook will be of interest to two main audiences:

- For engineers, it provides a handy reference to a huge variety of state-of-the-art optimization techniques essential to the various fields of engineering.
- For optimization researchers, it provides numerous examples of successful engineering applications as well as a broad range of research areas to further explore.

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We also thank all those who prepared chapters. We were deeply saddened to learn that one of the contributors, Christodoulos (Chris) Floudas, died just as the handbook was being completed. Professor Floudas was a leading expert in the application of mathematical optimization to complex systems and was consistently at the forefront of developments in both chemical engineering and global optimization. He was the author of more than 300 scientific publications; among his top honors were his

elected memberships to the U.S. National Academy of Engineering, the Academy of Athens, and the U.S. National Academy of Inventors. He will be sorely missed.

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