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Design and Practice in Manufacturing

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Fei Tao
Lin Zhang
Yuanjun Laili
School of Automation Science
and Electrical Engineering
Beihang University (BUAA)
Beijing
China

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Contents

Part I
Introduction and Overview

Intelligent optimization algorithm, which is also called meta-heuristic, is a kind of optimization algorithm that simulates natural phenomena and behaviors with population-based iterations. Its appearance had found a way out for NP-hard problems that are difficult to be solved by many classical deterministic algorithms, and it is able to find feasible suboptimal solutions for complex problems in a relatively short period of time.

The strong versatility, high speed and robustness of intelligent optimization algorithm provide a variety of decision-making solutions for multi-constraint complex numerical and combinatorial optimization problems such as multi-objective service composition, workflow scheduling, manufacturing resource allocation and product quality evaluation and controlling and so on in networked service-oriented manufacturing system. Moreover, it takes advantages of intelligent learning to avoid a large solution space traversal so that the problems can be easily solved. Today, most feasible solutions of these complex manufacturing problems are given by different types of intelligent optimization algorithm. Classic intelligent optimization algorithms, such as genetic algorithm (GA), particle swarm optimization (PSO) and ant colony optimization (ACO) and so on, are also widely reconstructed with various improved and hybrid strategies to adapt different production environments and applications. With highly distributed resources, productions and logistics, more and more improvements or hybridizations are designed to achieve efficient decision-making in every link of product. Intelligent optimization algorithm becomes indispensible in manufacturing.

Therefore, in the Part I of this book, a preliminary introduction of intelligent optimization algorithm and the main optimization problem in manufacturing is presented. This part contains Chaps. 1 and 2. The Chap. 1 presents an overview of the principles, development history and classification of the algorithm. It summarizes the classification of current research emphasis and major trends. The Chap. 2 is a brief overview of complex manufacturing optimization problems, their solution methods and the development of intelligent optimization algorithm in them. From the classification of optimization problems in manufacturing sys-