

# Preface

Nature-inspired computing provides promising and effective approaches for problem solving in optimization, machine intelligence, data mining and resource management. Nature has evolved over millions of years under a variety of challenging environments and can thus provide a rich source of inspiration for designing algorithms and approaches to tackle challenging problems in real-world applications.

The success of these algorithms in applications has increased their popularity in recent years, and active research has also led to the significant increase in the number of algorithms in recent years. It is estimated that about 140 different types of algorithms now exist in the literature, and this number is certainly gradually increasing. Researchers have tried to find inspiration from various sources in nature, such as ants, bees, fish, birds, mammals, plants, physical and chemical systems such as gravity, river systems, waves and pheromone. This leads to a diverse range of algorithms with different capabilities and different levels of performance.

However, such diversity may also cause confusion and distractions from important research topics. For example, many researchers wonder why such algorithms work and what their mathematical foundations for different search algorithms are. At the moment, it still lacks good theoretical understanding of metaheuristics. In fact, without a good mathematical framework, it is difficult to establish any solid mathematical foundation for analysing such algorithms. Such lack of theoretical analysis, together with different claims of results, it is understandable that misunderstanding and criticism have arisen in the research community concerning some metaheuristic algorithms.

There is a strong need for the whole research community to review carefully the developments concerning metaheuristics and bio-inspired computation so as to identify the key challenges, to inspire further research and to encourage innovative approaches that can help to develop effective tools for tackling hard problems in applications.

This book provides readers a timely snapshot of the state-of-the-art developments in the field of nature-inspired computing and its application in optimization, with the emphasis on both new applications and analysis of algorithms in their

implementation context. Therefore, this book is intended as a practice-oriented reference guide for students, researchers and professionals.

Despite the recent developments and the success of these algorithms, there are still some key issues that need further investigation. For example, there still lacks a general mathematical framework for analysing nature-inspired algorithms. In addition, the applications and case studies in the current literature have not focused on the large-scale problems yet. Thus, it is hoped that this book can inspire further research with a special focus on finding solutions for key challenges, including theoretical analysis, benchmarking, performance evaluation and large-scale applications.

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