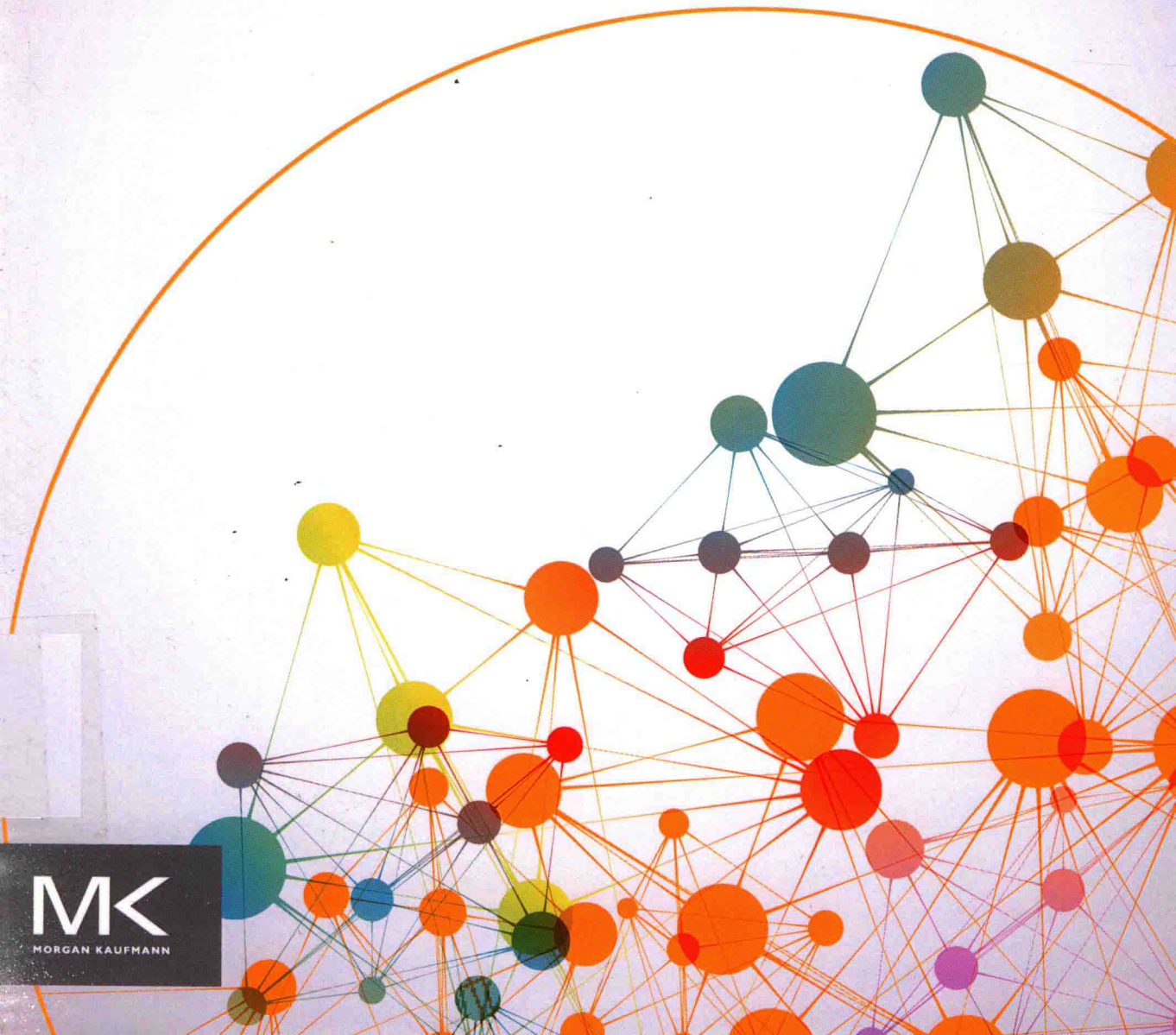
BIO-INSPIRED COMPUTATION IN TELECOMMUNICATIONS

Edited by Xin-She Yang, Su Fong Chien, Tiew On Ting



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Bio-Inspired Computation in Telecommunications

Preface

Humankind has always been fascinated by new ways of communication. Modern telecommunications have a huge impact on the ways we live, work, and think. In fact, modern telecommunications involve a vast array of algorithms, approaches, and technologies. Among many objectives and requirements concerning telecommunications, a key objective is to transmit signals with the optimal quality, least energy consumption, maximum capacity, and highest speed. Such requirements pose a series of challenging optimization problems in telecommunications.

Many problems in telecommunications require sophisticated algorithms and approaches to solve them. In principle, such problems can be tackled by sophisticated optimization techniques; however, traditional approaches do not usually work well. In addition, the stringent time requirements and ever-increasing complexity in constraints and dimensionality have further complicated these challenging issues, which become even more relevant in the current networks and the future 5G networks. Such challenges necessitate new approaches and new methods such as bio-inspired computation.

Current trends in optimization tend to use bio-inspired algorithms and swarm intelligence. In fact, there have been significant developments in bio-inspired computation in recent years, and swarm-intelligence-based algorithms now form an increasingly important part of optimization methods and approaches. Such bio-inspired algorithms are flexible, versatile, and efficient. Consequently, these algorithms can be used to solve a wide range of problems in diverse applications.

The rapid advances in bio-inspired computation have resulted in a much richer literature in recent years. It is impossible to review and summarize a good fraction of the latest developments in both bio-inspired computation and telecommunications. Consequently, we must select from many topics, with the emphasis on state-of-the-art developments, so as to provide a timely snapshot of recent advances. Therefore, this book intends to provide a timely review on a selection of topics, including the analysis and overview of bio-inspired algorithms, bio-inspired approaches to telecommunications, firefly algorithm, intrusion detection systems, VoIP (Voice over Internet Protocol) quality prediction, IP-over-WDM (wavelength-division multiplexing) networks, radio resources management of 4G networks, robust transmission for heterogeneous networks with cognitive small cells, resource distribution for sustainable communication networks, multiobjective optimization in optical networks, cell coverage area optimization for green LTE (long-term evolution) cellular networks, optimal coverage optimization in wireless sensor networks, minimum interference channel assignment for multiradio wireless mesh networks, and others.

The diverse topics covered in this book can provide an ideal and timely source of literature and case studies for graduates, lecturers, engineers, and researchers in telecommunications, wireless communications, computer science, electrical and

electronic engineering, computational intelligence, and neural computing. It is our hope that this book can inspire more research to improve existing methodologies and create innovative technologies in telecommunications via bio-inspired methodologies.

We would like to thank our editors, Steven Elliot and Kaitlin Herbert, and the staff at Elsevier for their help and professionalism. Last but not least, we thank our families for their support and encouragement.

Xin-She Yang, Su Fong Chien, Tiew On Ting
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Contents

CHAPTER

1 Bio-Inspired Computation and Optimization: An Overview

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