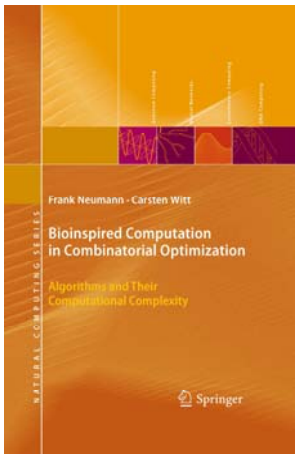
Bioinspired Computation in Combinatorial Optimization

Algorithms and Their Computational Complexity

Frank Neumann (Max Planck Institute for Informatics, Saarbrücken)
Carsten Witt (Technical University of Denmark, Lyngby)



Natural Computing Series

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Overview

Bioinspired computation methods, such as evolutionary algorithms and ant colony optimization, are being applied successfully to complex engineering and combinatorial optimization problems, and it is very important that we understand the computational complexity of these algorithms. This is the first book to explain the most important results achieved in this area.

The authors show how runtime behavior can be analyzed in a rigorous way, in particular for combinatorial optimization. They present well-known problems such as minimum spanning trees, shortest paths, maximum matching, and covering and scheduling problems. Classical single-objective optimazation is examined first. They then investigate the computational complexity of bioinspired computation applied to multiobjective variants of the considered combinatorial optimization problems, and in particular they show how multiobjective optimization can help to speed up bioinspired computation for single-objective optimization problems.

This book will be valuable for graduate and advanced undergraduate courses on bioinspired computation, as it offers clear assessments of the benefits and drawbacks of various methods. It offers a self-contained presentation, theoretical foundations of the techniques, a unified framework for analysis, and explanations of common proof techniques, so it can also be used as a reference for researchers in the areas of natural computing, optimization and computational complexity.

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References

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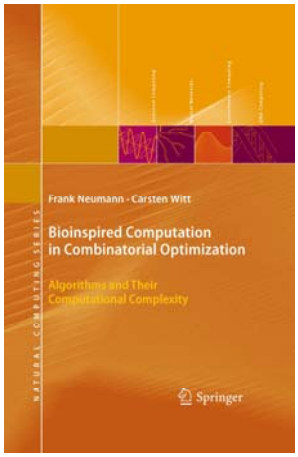

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Comments

Bioinspired computing is successful in practice. Over the past decade a body of theory for bioinspired computing has been developed. The authors have contributed significantly to this body and give a highly readable account of it.

Kurt Mehlhorn, Max Planck Institute for Informatics, and Saarland University, Germany

Bioinspired algorithms belong to the most powerful methods used to tackle real world optimization problems. This book gives such algorithms a solid foundation. It presents some of the most exciting results that have been obtained in bioinspired computing in the last decade.

Zbigniew Michalewicz, University of Adelaide, Australia

This book presents a most welcome theoretical computer science approach and perspective to the design and analysis of discrete evolutionary algorithms. It describes the design and derivation of evolutionary algorithms which have precise computation complexity bounds for combinatorial optimization. The book should appeal to researchers and practitioners of evolutionary algorithms and computation who want to learn the state of the art in evolutionary algorithm theory.

Una-May O'Reilly, CSAIL, MIT, USA

The evolutionary computation community has been in need of rigorous results concerning the computational complexity of their approaches for decades. This is the first textbook covering such a fundamental topic. It provides an excellent overview of the state of the art in this research area, in terms of both the results obtained and the analytical methods. It is an indispensable book for everyone who is interested in the foundations of evolutionary computation.

Xin Yao, University of Birmingham, UK