

---

# Metaheuristics From Design To Implementation Wiley

---

Theory and Principled Methods for the Design of  
Metaheuristics

Handbook of Metaheuristics

Recent Developments in Metaheuristics

Nature-Inspired Methods for Metaheuristics  
Optimization

Metaheuristics in Water, Geotechnical and  
Transport Engineering

Modeling, Analysis, and Applications in  
Metaheuristic Computing: Advancements and  
Trends

Nature-Inspired Metaheuristic Algorithms for  
Engineering Optimization Applications

Metaheuristic Computation with MATLAB®  
Matheuristics

Metaheuristic Applications in Structures and  
Infrastructures

Metaheuristic Applications in Structures and  
Infrastructures

Metaheuristics:

Metaheuristics for Business Analytics

Hybrid Metaheuristics

Engineering Stochastic Local Search Algorithms.  
Designing, Implementing and Analyzing Effective  
Heuristics  
Metaheuristics  
Metaheuristics and Nature Inspired Computing  
Optimization and Learning  
Metaheuristics for Scheduling in Distributed  
Computing Environments  
Hybrid Metaheuristics  
Metaheuristics in Water, Geotechnical and  
Transport Engineering  
Computer Engineering: Concepts, Methodologies,  
Tools and Applications  
Metaheuristic Optimization: Nature-Inspired  
Algorithms Swarm and Computational  
Intelligence, Theory and Applications  
Interfaces in Computer Science and Operations  
Research  
Meta-heuristic and Evolutionary Algorithms for  
Engineering Optimization  
Metaheuristics for Bi-level Optimization  
Hybrid Metaheuristics  
Recent Advances in Hybrid Metaheuristics for  
Data Clustering  
Multi-Objective Optimization in Theory and  
Practice II: Metaheuristic Algorithms  
Metaheuristics: Outlines, MATLAB Codes and  
Examples  
Metaheuristics and Optimization in Civil  
Engineering  
Hybrid Metaheuristics  
Metaheuristics in Machine Learning: Theory and

Applications  
Engineering Optimization  
Nature-inspired Metaheuristic Algorithms  
Essentials of Metaheuristics (Second Edition)  
Metaheuristic Applications in Structures and  
Infrastructures  
Advances in Metaheuristics  
Optimization of Integer/Fractional Order Chaotic  
Systems by Metaheuristics and their Electronic  
Realization  
Metaheuristics

Metaheuristics  
From Design To  
Implementation Downloaded from  
hl.uconnect.hi.u.edu.vn  
by guest  
Wiley

---

**HOGAN  
TYRONE**

---

**Theory and  
Principled  
Methods for  
the Design  
of  
Metaheuristic**

**cs** CRC Press  
The disciplines  
of computer  
science and  
operations  
research (OR)  
have been  
linked since  
their origins,

each  
contributing to  
the dramatic  
advances of  
the other. This  
work explores  
the  
connections  
between these  
key  
technologies:  
how high-  
performance  
computing  
methods have  
led to  
advances in  
OR de  
ployment, and  
how OR has

contributed to  
the design  
and  
development  
of ad vanced  
systems. The  
collected  
writings-from  
researchers  
and  
practitioners  
in Computer  
Science,  
Operations  
Research,  
Management  
Science, and  
Artificial  
Intelligence-  
were among

those delivered at the Fifth INFORMS Computer Science Technical Section Conference in Dallas, Texas, January 8-10, 1996. The articles advance both theory and practice. Presented are new approaches to complex problems based on: metaheuristics (neural networks, genetic algorithms, and Tabu Search), optimization and mathematical programming,

stochastic methods, constraint programming, and logical analysis. These advanced methodologies are applied to new applications in such areas as: telecom network design, financial engineering, manufacturing, project management, and forecasting, airline and machine scheduling, vehicle routing, modeling and decision support systems.

Featured is a remarkable paper by keynote speaker Fred Glover, creator of the Tabu Search family of metaheuristics. In it he develops the principles of memory-based heuristic methods, contrasts them with the popular genetic algorithms and simulated annealing, provides a sweeping survey of application vignettes, and points to promising avenues for

future research.  
*Handbook of Metaheuristics*  
John Wiley & Sons  
This book provides a complete background on metaheuristics to solve complex bi-level optimization problems (continuous/discrete, mono-objective/multi-objective) in a diverse range of application domains. Readers learn to solve large scale bi-level optimization problems by efficiently combining

metaheuristics with complementary metaheuristics and mathematical programming approaches. Numerous real-world examples of problems demonstrate how metaheuristics are applied in such fields as networks, logistics and transportation, engineering design, finance and security.  
**Recent Developments in Metaheuristics** Newnes  
Metaheuristic algorithms are

considered as generic optimization tools that can solve very complex problems characterized by having very large search spaces. Metaheuristic methods reduce the effective size of the search space through the use of effective search strategies. Book Features: Provides a unified view of the most popular metaheuristic methods currently in use Includes the necessary

concepts to enable readers to implement and modify already known metaheuristic methods to solve problems. Covers design aspects and implementation in MATLAB®. Contains numerous examples of problems and solutions that demonstrate the power of these methods of optimization. The material has been written from a teaching perspective and, for this reason, this book is

primarily intended for undergraduate and postgraduate students of artificial intelligence, metaheuristic methods, and/or evolutionary computation. The objective is to bridge the gap between metaheuristic techniques and complex optimization problems that profit from the convenient properties of metaheuristic approaches. Therefore, engineer practitioners who are not familiar with

metaheuristic computation will appreciate that the techniques discussed are beyond simple theoretical tools, since they have been adapted to solve significant problems that commonly arise in such areas. *Nature-Inspired Methods for Metaheuristics Optimization* Springer Nature Metaheuristics : Progress as Real Problem Solvers is a peer-reviewed volume of eighteen current,

cutting-edge papers by leading researchers in the field. Included are an invited paper by F. Glover and G. Kochenberger, which discusses the concept of Metaheuristic agent processes, and a tutorial paper by M.G.C. Resende and C.C. Ribeiro discussing GRASP with path-relinking. Other papers discuss problem-solving approaches to timetabling, automated planograms,

elevators, space allocation, shift design, cutting stock, flexible shop scheduling, colorectal cancer and cartography. A final group of methodology papers clarify various aspects of Metaheuristics from the computational view point. **Metaheuristics in Water, Geotechnical and Transport Engineering** Springer  
This timely book deals with a current topic, i.e. the applications of metaheuristic

algorithms, with a primary focus on optimization problems in civil engineering. The first chapter offers a concise overview of different kinds of metaheuristic algorithms, explaining their advantages in solving complex engineering problems that cannot be effectively tackled by traditional methods, and citing the most important works for further

reading. The remaining chapters report on advanced studies on the applications of certain metaheuristic algorithms to specific engineering problems. Genetic algorithm, bat algorithm, cuckoo search, harmony search and simulated annealing are just some of the methods presented and discussed step by step in real-application contexts, in which they are often used in

combination with each other. Thanks to its synthetic yet meticulous and practice-oriented approach, the book is a perfect guide for graduate students, researchers and professionals willing to applying metaheuristic algorithms in civil engineering and other related engineering fields, such as mechanical, transport and geotechnical engineering. It is also a valuable aid for both

lectures and advanced engineering students.

**Modeling, Analysis, and Applications in Metaheuristic Computing: Advancements and Trends**  
Springer Science & Business Media

The book presents eight well-known and often used algorithms besides nine newly developed algorithms by the first author and his students in a



practical implementation framework. Matlab codes and some benchmark structural optimization problems are provided. The aim is to provide an efficient context for experienced researchers or readers not familiar with theory, applications and computational developments of the considered metaheuristics. The information will also be of interest to readers interested in

application of metaheuristics for hard optimization, comparing conceptually different metaheuristics and designing new metaheuristics. *Nature-Inspired Metaheuristic Algorithms for Engineering Optimization Applications* Springer Modern metaheuristic algorithms such as bee algorithms and harmony search start to demonstrate their power in dealing with tough optimization

problems and even NP-hard problems. This book reviews and introduces the state-of-the-art nature-inspired metaheuristic algorithms in optimization, including genetic algorithms, bee algorithms, particle swarm optimization, simulated annealing, ant colony optimization, harmony search, and firefly algorithms. We also briefly introduce the photosynthetic algorithm, the enzyme

algorithm, and Tabu search. Worked examples with implementation have been used to show how each algorithm works. This book is thus an ideal textbook for an undergraduate and/or graduate course. As some of the algorithms such as the harmony search and firefly algorithms are at the forefront of current research, this book can also serve as a reference

book for researchers. *Metaheuristic Computation with MATLAB®* IGI Global This essential metaheuristics tutorial provides descriptions and practical applications in the area of business analytics. It addresses key problems in predictive and prescriptive analysis, while also illustrating how problems that arise in business analytics can be modelled and how metaheuristics can be used to

find high-quality solutions. Readers will be introduced to decision-making problems for which metaheuristics offer the most effective solution technique. The book not only shows business problem modelling on a spreadsheet but also how to design and create a Visual Basic for Applications code. Extra Material can be downloaded at <http://extras.springer.com/9>

78-3-319-6811  
7-7.  
*Matheuristics*  
Springer  
The third  
edition of this  
handbook is  
designed to  
provide a  
broad  
coverage of  
the concepts,  
implementatio  
ns, and  
applications in  
metaheuristics  
. The book's  
chapters serve  
as stand-alone  
presentations  
giving both  
the necessary  
underpinnings  
as well as  
practical  
guides for  
implementatio  
n. The nature  
of  
metaheuristics  
invites an  
analyst to

modify basic  
methods in  
response to  
problem  
characteristics  
, past  
experiences,  
and personal  
preferences,  
and the  
chapters in  
this handbook  
are designed  
to facilitate  
this process  
as well. This  
new edition  
has been fully  
revised and  
features new  
chapters on  
swarm  
intelligence  
and  
automated  
design of  
metaheuristics  
from flexible  
algorithm  
frameworks.  
The authors  
who have

contributed to  
this volume  
represent  
leading  
figures from  
the  
metaheuristic  
community  
and are  
responsible for  
pioneering  
contributions  
to the fields  
they write  
about. Their  
collective  
work has  
significantly  
enriched the  
field of  
optimization  
in general and  
combinatorial  
optimization  
in  
particular. Met  
aheuristics are  
solution  
methods that  
orchestrate an  
interaction  
between local

improvement procedures and higher level strategies to create a process capable of escaping from local optima and performing a robust search of a solution space. In addition, many new and exciting developments and extensions have been observed in the last few years. Hybrids of metaheuristics with other optimization techniques, like branch-and-bound,

mathematical programming or constraint programming are also increasingly popular. On the front of applications, metaheuristics are now used to find high-quality solutions to an ever-growing number of complex, ill-defined real-world problems, in particular combinatorial ones. This handbook should continue to be a great reference for researchers, graduate students, as well as

practitioners interested in metaheuristics . Metaheuristic Applications in Structures and Infrastructures Luniver Press Mathematicians have devised different chaotic systems that are modeled by integer or fractional-order differential equations, and whose mathematical models can generate chaos or hyperchaos. The numerical methods to simulate those integer and fractional-

<p>order chaotic systems are quite different and their exactness is responsible in the evaluation of characteristics like Lyapunov exponents, Kaplan-Yorke dimension, and entropy. One challenge is estimating the step-size to run a numerical method. It can be done analyzing the eigenvalues of self-excited attractors, while for hidden attractors it is difficult to evaluate the equilibrium points that are</p>	<p>required to formulate the Jacobian matrices. Time simulation of fractional-order chaotic oscillators also requires estimating a memory length to achieve exact results, and it is associated to memories in hardware design. In this manner, simulating chaotic/hyperchaotic oscillators of integer/fractional-order and with self-excited/hidden attractors is quite important to evaluate their</p>	<p>Lyapunov exponents, Kaplan-Yorke dimension and entropy. Further, to improve the dynamics of the oscillators, their main characteristics can be optimized applying metaheuristics , which basically consists of varying the values of the coefficients of a mathematical model. The optimized models can then be implemented using commercially available amplifiers,</p>
--	--	---

field-programmable analog arrays (FPAA), field-programmable gate arrays (FPGA), microcontrollers, graphic processing units, and even using nanometer technology of integrated circuits. The book describes the application of different numerical methods to simulate integer/fractional-order chaotic systems. These methods are used within optimization loops to

maximize positive Lyapunov exponents, Kaplan-Yorke dimension, and entropy. Single and multi-objective optimization approaches applying metaheuristics are described, as well as their tuning techniques to generate feasible solutions that are suitable for electronic implementation. The book details several applications of chaotic oscillators such as in random bit/number

generators, cryptography, secure communications, robotics, and Internet of Things.

### **Metaheuristic**

### **Applications in Structures and**

### **Infrastructure**

Newnes  
This book is a collection of the most recent approaches that combine metaheuristics and machine learning. Some of the methods considered in this book are evolutionary, swarm, machine learning, and deep learning.

The chapters were classified based on the content; then, the sections are thematic. Different applications and implementations are included; in this sense, the book provides theory and practical content with novel machine learning and metaheuristic algorithms. The chapters were compiled using a scientific perspective. Accordingly, the book is primarily intended for undergraduate and

postgraduate students of Science, Engineering, and Computational Mathematics and is useful in courses on Artificial Intelligence, Advanced Machine Learning, among others. Likewise, the book is useful for research from the evolutionary computation, artificial intelligence, and image processing communities. *Metaheuristics*: Springer This book highlights state-of-the-art

developments in metaheuristics research. It examines all aspects of metaheuristic research including new algorithmic developments, applications, new research challenges, theoretical developments, implementation issues, in-depth experimental studies. The book is divided into two sections. Part I is focused on new optimization and modeling techniques based on metaheuristics

. The chapters in this section cover topics from multi-objective problems with fuzzy data with triangular-valued objective functions, to hyper-heuristics optimization methodology, designing genetic algorithms, and also the cuckoo search algorithm. The techniques described help to enhance the usability and increase the potential of metaheuristic algorithms. Part II

showcases advanced metaheuristic approaches to solve real-life applications issues. This includes an examination of scheduling, the vehicle routing problem, multimedia sensor network, supplier selection, bin packing, objects tracking, and radio frequency identification. In the fields covered in the chapters are of high-impact applications of metaheuristics . The chapters offer

innovative applications of metaheuristics that have a potential of widening research frontiers. Altogether, this book offers a comprehensive look at how researchers are currently using metaheuristics in different domains of design and application. **Metaheuristics for Business Analytics** Springer Nature This book constitutes the refereed proceedings of the 4th



International Workshop on Hybrid Metaheuristics , HM 2007, held in Dortmund, Germany. The 14 revised full papers discuss specific aspects of hybridization of metaheuristics , hybrid metaheuristics design, development and testing. With increasing attention to methodological aspects, from both the empirical and theoretical sides, the papers show a representative sample of research in the field of hybrid metaheuristics . *Hybrid Metaheuristics* Springer Nature An authoritative guide to an in-depth analysis of various state-of-the-art data clustering approaches using a range of computational intelligence techniques Recent Advances in Hybrid Metaheuristics for Data Clustering offers a guide to the fundamentals of various metaheuristics and their application to data clustering. Metaheuristics are designed to tackle complex clustering problems where classical clustering algorithms have failed to be either effective or efficient. The authors—note d experts on the topic—provide a text that can aid in the design and development of hybrid metaheuristics to be applied to data

clustering. The book includes performance analysis of the hybrid metaheuristics in relationship to their conventional counterparts. In addition to providing a review of data clustering, the authors include in-depth analysis of different optimization algorithms. The text offers a step-by-step guide in the build-up of hybrid metaheuristics and to enhance comprehension. In addition, the book contains a

range of real-life case studies and their applications. This important text: Includes performance analysis of the hybrid metaheuristics as related to their conventional counterparts Offers an in-depth analysis of a range of optimization algorithms Highlights a review of data clustering Contains a detailed overview of different standard metaheuristics in current use Presents a step-by-step

guide to the build-up of hybrid metaheuristics Offers real-life case studies and applications Written for researchers, students and academics in computer science, mathematics, and engineering, Recent Advances in Hybrid Metaheuristics for Data Clustering provides a text that explores the current data clustering approaches using a range of computational

intelligence techniques. Engineering Stochastic Local Search Algorithms. Designing, Implementing and Analyzing Effective Heuristics Elsevier Inc. Chapters The main goal of this book is to provide a state of the art of hybrid metaheuristics . The book provides a complete background that enables readers to design and implement hybrid metaheuristics to solve complex optimization

problems (continuous/discrete, mono-objective/multi-objective, optimization under uncertainty) in a diverse range of application domains. Readers learn to solve large scale problems quickly and efficiently combining metaheuristics with complementary metaheuristics , mathematical programming, constraint programming and machine learning. Numerous

real-world examples of problems and solutions demonstrate how hybrid metaheuristics are applied in such fields as networks, logistics and transportation , bio-medical, engineering design, scheduling. **Metaheuristics** Springer Science & Business Media An accessible introduction to metaheuristics and optimization, featuring powerful and modern algorithms for application across

engineering and the sciences. From engineering and computer science to economics and management science, optimization is a core component for problem solving. Highlighting the latest developments that have evolved in recent years, *Engineering Optimization: An Introduction with Metaheuristic Applications* outlines popular metaheuristic algorithms

and equips readers with the skills needed to apply these techniques to their own optimization problems. With insightful examples from various fields of study, the author highlights key concepts and techniques for the successful application of commonly-used metaheuristic algorithms, including simulated annealing, particle swarm optimization, harmony search, and genetic algorithms.

The author introduces all major metaheuristic algorithms and their applications in optimization through a presentation that is organized into three succinct parts: *Foundations of Optimization* and *Algorithms* provides a brief introduction to the underlying nature of optimization and the common approaches to optimization problems, random number generation,

the Monte Carlo method, and the Markov chain Monte Carlo method. Metaheuristic Algorithms presents common metaheuristic algorithms in detail, including genetic algorithms, simulated annealing, ant algorithms, bee algorithms, particle swarm optimization, firefly algorithms, and harmony search. Applications outlines a wide range of applications that use metaheuristic algorithms to solve challenging optimization problems with detailed implementation while also introducing various modifications used for multi-objective optimization. Throughout the book, the author presents worked-out examples and real-world applications that illustrate the modern relevance of the topic. A detailed appendix features important and popular algorithms using MATLAB® and Octave software packages, and a related FTP site houses MATLAB code and programs for easy implementation of the discussed techniques. In addition, references to the current literature enable readers to investigate individual algorithms and methods in greater detail. Engineering Optimization: An Introduction with

Metaheuristic Applications is an excellent book for courses on optimization and computer simulation at the upper-undergraduate and graduate levels. It is also a valuable reference for researchers and practitioners working in the fields of mathematics, engineering, computer science, operations research, and management science who use metaheuristic algorithms to

solve problems in their everyday work. *Metaheuristics and Nature Inspired Computing* Springer  
This volume is centered on exemplifying how metaheuristics have acquired a prominent role in supporting the decision making process of practitioners dealing with complex real-world problems arising in different fields and realms of application. The conference

was centered on presenting original and innovative approaches dealing with metaheuristic algorithms from two broad perspectives:  
• Application oriented perspective: A large number of contributions can be labelled “application oriented,” since they present successful application of metaheuristics to real world problems arising in different fields; • Methodologica

I perspective: In line with recent trends in metaheuristics , researchers have devoted a great deal of attention to the “hows” and “whys” of metaheuristics , studying, e.g., what is the impact of a given feature of a metaheuristic on the final performance of the algorithm, how to fine tune and calibrate a metaheuristic, how to properly design and combine neighborhood s and so forth.

The conference was organized for the benefit of researchers and practitioners from 25 different countries. A total of 117 attendees were present for the conference in Hamburg. During the conference, a total of 94 presentations were given in these subject areas, representing both research and applications. Of these, 37 papers were submitted for publication in the post conference volume. These papers were peer reviewed, resulting in a select number of high quality papers that are represented in this volume. The organization of this volume follows the more general structure of the conference itself. The volume can be broadly divided into two main sections: “Methodology ” and “Applications. ” Within each chapter of the “Methodology

" section, the reader is driven inside a metaheuristic, with the aim of grasping how and why a certain feature works, how neighborhoods can be effectively designed, combined, and implemented, how a metaheuristic should be fine-tuned, along with other methodological issues. The focus of these chapters lies more on the metaheuristic itself, as opposed to a more application

oriented approach of the second part of the book. The second part of the book, "Applications," presents a number of contributions that illustrate how metaheuristics have been successfully employed to tackle either classical problems from the literature or real-world problems from the industry. **Optimization and Learning** Springer  
 "This book is a collection of the latest developments, models, and

applications within the transdisciplinary fields related to metaheuristic computing, providing readers with insight into a wide range of topics such as genetic algorithms, differential evolution, and ant colony optimization"-- Provided by publisher.  
[Metaheuristics for Scheduling in Distributed Computing Environments](#)  
 Springer  
 Grid computing has emerged as one of the most promising



computing paradigms of the new millennium! Achieving high performance Grid computing requires techniques to efficiently and adaptively allocate jobs and applications to available resources in a large scale, highly heterogenous and dynamic environment. This volume presents meta-heuristics approaches for Grid scheduling problems. Due to the complex nature of the problem, meta-heuristics are primary techniques for the design and implementation of efficient Grid schedulers. The volume brings new ideas, analysis, implementations and evaluation of meta-heuristic techniques for Grid scheduling, which make this volume novel in several aspects. The 14 chapters of this volume have identified several important formulations of the problem, which we believe will serve as a reference for the researchers in the Grid computing community. Important features include the detailed overview of the various novel metaheuristic scheduling approaches, excellent coverage of timely, advanced scheduling topics, state-of-the-art theoretical

research and application developments and chapters authored by pioneers in the field. Academics, scientists as well as engineers engaged in research, development and scheduling will find the comprehensive coverage of this book invaluable.

### **Hybrid Metaheuristics**

Springer Nature  
A detailed review of a wide range of meta-heuristic and evolutionary algorithms in

a systematic manner and how they relate to engineering optimization problems. This book introduces the main metaheuristic algorithms and their applications in optimization. It describes 20 leading meta-heuristic and evolutionary algorithms and presents discussions and assessments of their performance in solving optimization problems from several fields of engineering.

The book features clear and concise principles and presents detailed descriptions of leading methods such as the pattern search (PS) algorithm, the genetic algorithm (GA), the simulated annealing (SA) algorithm, the Tabu search (TS) algorithm, the ant colony optimization (ACO), and the particle swarm optimization (PSO) technique. Chapter 1 of Meta-heuristic and Evolutionary

<p>Algorithms for Engineering Optimization provides an overview of optimization and defines it by presenting examples of optimization problems in different engineering domains. Chapter 2 presents an introduction to meta-heuristic and evolutionary algorithms and links them to engineering problems. Chapters 3 to 22 are each devoted to a separate algorithm—and they each start with a brief literature</p>	<p>review of the development of the algorithm, and its applications to engineering problems. The principles, steps, and execution of the algorithms are described in detail, and a pseudo code of the algorithm is presented, which serves as a guideline for coding the algorithm to solve specific applications. This book: Introduces state-of-the-art metaheuristic algorithms and their applications to</p>	<p>engineering optimization; Fills a gap in the current literature by compiling and explaining the various meta-heuristic and evolutionary algorithms in a clear and systematic manner; Provides a step-by-step presentation of each algorithm and guidelines for practical implementation and coding of algorithms; Discusses and assesses the performance of metaheuristic algorithms in multiple problems from</p>
---	--	---

many fields of engineering; Relates optimization algorithms to engineering problems employing a unifying approach. Meta-heuristic and Evolutionary Algorithms for Engineering Optimization is a reference intended for students, engineers, researchers, and

instructors in the fields of industrial engineering, operations research, optimization/mathematics, engineering optimization, and computer science. OMID BOZORG-HADDAD, PhD, is Professor in the Department of Irrigation and Reclamation Engineering at the University of Tehran,

Iran. MOHAMMAD SOLGI, M.Sc., is Teacher Assistant for M.Sc. courses at the University of Tehran, Iran. HUGO A. LOÁICIGA, PhD, is Professor in the Department of Geography at the University of California, Santa Barbara, United States of America.