

Modeling and Optimization in Science and Technologies

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# Metaheuristics and Optimization in Civil Engineering

 Springer

# Metaheuristics Optimization Engineering Modeling Technologies

**JS Bruner**



## **Metaheuristics Optimization Engineering Modeling Technologies:**

Metaheuristics and Optimization in Civil Engineering Xin-She Yang, Gebrail Bekdaş, Sinan Melih Nigdeli, 2015-12-10 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 apply 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. *Nature-Inspired Methods for Metaheuristics Optimization* Fouad Bennis, Rajib Kumar Bhattacharjya, 2020-01-17 This book gathers together a set of chapters covering recent developments in optimization methods that are inspired by nature. The first group of chapters describes in detail different metaheuristic algorithms and shows their applicability using some test or real-world problems. The second part of the book is especially focused on advanced applications and case studies. They span different engineering fields including mechanical, electrical, and civil engineering and earth environmental science and covers topics such as robotics, water management, process optimization, among others. The book covers both basic concepts and advanced issues offering a timely introduction to nature-inspired optimization methods for newcomers and students and a source of inspiration as well as important practical insights to engineers and researchers. *Metaheuristics for Machine Learning* Kanak Kalita, Narayanan Ganesh, S. Balamurugan, 2024-03-28 METAHEURISTICS for MACHINE LEARNING The book unlocks the power of nature-inspired optimization in machine learning and presents a comprehensive guide to cutting-edge algorithms, interdisciplinary insights, and real-world applications. The field of metaheuristic optimization algorithms is experiencing rapid growth both in academic research and industrial applications. These nature-inspired algorithms, which draw on phenomena like evolution, swarm behavior, and neural systems, have shown remarkable efficiency in solving complex optimization problems. With advancements in machine learning and artificial intelligence, the application of metaheuristic optimization techniques has expanded, demonstrating significant potential in optimizing machine learning models, hyperparameter tuning, and feature selection among other use cases. In the industrial landscape, these techniques are becoming indispensable for solving real-world problems in sectors ranging from healthcare to cybersecurity and sustainability. Businesses are incorporating metaheuristic optimization into machine learning workflows to improve decision-making, automate processes,

and enhance system performance As the boundaries of what is computationally possible continue to expand the integration of metaheuristic optimization and machine learning represents a pioneering frontier in computational intelligence making this book a timely resource for anyone involved in this interdisciplinary field *Metaheuristics for Machine Learning Algorithms and Applications* serves as a comprehensive guide to the intersection of nature inspired optimization and machine learning Authored by leading experts this book seamlessly integrates insights from computer science biology and mathematics to offer a panoramic view of the latest advancements in metaheuristic algorithms You ll find detailed yet accessible discussions of algorithmic theory alongside real world case studies that demonstrate their practical applications in machine learning optimization Perfect for researchers practitioners and students this book provides cutting edge content with a focus on applicability and interdisciplinary knowledge Whether you aim to optimize complex systems delve into neural networks or enhance predictive modeling this book arms you with the tools and understanding you need to tackle challenges efficiently Equip yourself with this essential resource and navigate the ever evolving landscape of machine learning and optimization with confidence Audience The book is aimed at a broad audience encompassing researchers practitioners and students in the fields of computer science data science engineering and mathematics The detailed but accessible content makes it a must have for both academia and industry professionals interested in the optimization aspects of machine learning algorithms

Optimization Using Evolutionary Algorithms and Metaheuristics Kaushik Kumar,J. Paulo Davim,2019-08-22 Recognized as a Recommended title by Choice for their April 2021 issue Choice is a publishing unit at the Association of College Research Libraries ACR L a division of the American Library Association Choice has been the acknowledged leader in the provision of objective high quality evaluations of nonfiction academic writing *Metaheuristic optimization* is a higher level procedure or heuristic designed to find generate or select a heuristic partial search algorithm that may provide a sufficiently good solution to an optimization problem especially with incomplete or imperfect information or limited computation capacity This is usually applied when two or more objectives are to be optimized simultaneously This book is presented with two major objectives Firstly it features chapters by eminent researchers in the field providing the readers about the current status of the subject Secondly algorithm based optimization or advanced optimization techniques which are applied to mostly non engineering problems are applied to engineering problems This book will also serve as an aid to both research and industry Usage of these methodologies would enable the improvement in engineering and manufacturing technology and support an organization in this era of low product life cycle Features Covers the application of recent and new algorithms Focuses on the development aspects such as including surrogate modeling parallelization game theory and hybridization Presents the advances of engineering applications for both single objective and multi objective optimization problems Offers recent developments from a variety of engineering fields Discusses *Optimization using Evolutionary Algorithms and Metaheuristics applications in engineering* *Nature-inspired Methods for Metaheuristics Optimization* ,2020 This book gathers together a

set of chapters covering recent development in optimization methods that are inspired by nature The first group of chapters describes in detail different meta heuristic algorithms and shows their applicability using some test or real world problems The second part of the book is especially focused on advanced applications and case studies They span different engineering fields including mechanical electrical and civil engineering and earth environmental science and covers topics such as robotics water management process optimization among others The book covers both basic concepts and advanced issues offering a timely introduction to nature inspired optimization method for newcomers and students and a source of inspiration as well as important practical insights to engineers and researchers

**Advancing Technology Industrialization Through Intelligent Software Methodologies, Tools and Techniques** Hamido Fujita, Ali Selamat, 2019-09-15 Software has become ever more crucial as an enabler from daily routines to important national decisions But from time to time as society adapts to frequent and rapid changes in technology software development fails to come up to expectations due to issues with efficiency reliability and security and with the robustness of methodologies tools and techniques not keeping pace with the rapidly evolving market This book presents the proceedings of SoMeT\_19 the 18th International Conference on New Trends in Intelligent Software Methodologies Tools and Techniques held in Kuching Malaysia from 23-25 September 2019 The book explores new trends and theories that highlight the direction and development of software methodologies tools and techniques and aims to capture the essence of a new state of the art in software science and its supporting technology and to identify the challenges that such a technology will have to master The book also investigates other comparable theories and practices in software science including emerging technologies from their computational foundations in terms of models methodologies and tools The 56 papers included here are divided into 5 chapters Intelligent software systems design and techniques in software engineering Machine learning techniques for software systems Requirements engineering software design and development techniques Software methodologies tools and techniques for industry and Knowledge science and intelligent computing This comprehensive overview of information systems and research projects will be invaluable to all those whose work involves the assessment and solution of real world software problems

Local Search for Planning and Scheduling Alexander Nareyek, 2003-06-30 This book constitutes the thoroughly refereed post proceedings of the International Workshop on Local Search for Planning and Scheduling held at a satellite workshop of ECAI 2000 in Berlin Germany in August 2000 The nine revised full papers presented together with an invited survey on meta heuristics have gone through two rounds of reviewing and improvement The papers are organized in topical sections on combinatorial optimization planning with resources and related approaches

Advances in Smart Vehicular Technology, Transportation, Communication and Applications Tsu-Yang Wu, Shaoquan Ni, Jeng-Shyang Pan, Shu-Chuan Chu, 2025-07-23 This book includes selected papers from the sixth International Conference on Smart Vehicular Technology Transportation Communication and Applications VTCA 2024 hosted by Shu Te University and Taiwan Association for Web Intelligence Consortium and is

technically sponsored by National Kaohsiung University of Science and Technology and Nanchang Institute of Technology during April 16-18, 2024. The book includes research works from engineers, researchers, and practitioners interested in the advances and applications in the field of vehicle technology and communication. The book covers three tracks: namely, 1) vehicular electronics, 2) intelligent transportation systems and applications, and 3) vehicular networking security.

**Engineering Optimization** Xin-She Yang, 2010-07-20. 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. *Mechatronics Engineering and Modern Information Technologies in Industrial Engineering* Fang Shao, Fen Jie Long, Jie Liang, Hai Hong Chen, Mei Ni Yuan, 2015-01-13. Selected peer-reviewed papers from the 2014 International Conference on Mechatronics Engineering and Modern Technologies in Industrial Engineering (MEMTIE 2014), October 25-26, 2014, Changsha, Hunan, China.

Metaheuristics in Combinatorial Optimization Gilbert Laporte, Ibrahim H. Osman, 1996      Handbook of Research on Instructional Systems and Technology Holim Song, 2008 The Handbook of Research on Instructional Systems and Technology provides information on the different styles of instructional design methodologies tips and strategies on how to use technology to facilitate active learning as well as techniques to help faculty and researchers develop online instructional and teaching materials With over 65 chapters contributed by 119 of the world's leading experts in instructional systems the Handbook of Research on Instructional Systems and Technology enables libraries to provide a foundational reference to meet the information needs of researchers educators practitioners administrators and all other stakeholders in the context of instructional systems and technology      *Meta-heuristic Optimization Techniques* Anuj Kumar, Sangeeta Pant, Mangey Ram, Om Yadav, 2022-01-19 This book offers a thorough overview of the most popular and researched meta heuristic optimization techniques and nature inspired algorithms Their wide applicability makes them a hot research topic and an efficient tool for the solution of complex optimization problems in various fields of sciences engineering and in numerous industries      *Metaheuristic Optimization Algorithms* Laith Abualigah, 2024-05-05 Metaheuristic Optimization Algorithms Optimizers Analysis and Applications presents the most recent optimization algorithms and their applications across a wide range of scientific and engineering research fields Metaheuristic Optimization Algorithms have become indispensable tools with applications in data analysis text mining classification problems computer vision image analysis pattern recognition medicine and many others Most complex systems problems involve a continuous flow of data that makes it impossible to manage and analyze manually The outcome depends on the processing of high dimensional data most of it irregular and unordered present in various forms such as text images videos audio and graphics The authors of Meta Heuristic Optimization Algorithms provide readers with a comprehensive overview of eighteen optimization algorithms to address this complex data including Particle Swarm Optimization Algorithm Arithmetic Optimization Algorithm Whale Optimization Algorithm and Marine Predators Algorithm along with new and emerging methods such as Aquila Optimizer Quantum Approximate Optimization Algorithm Manta Ray Foraging Optimization Algorithm and Gradient Based Optimizer among others Each chapter includes an introduction to the modeling concepts used to create the algorithm followed by the mathematical and procedural structure of the algorithm associated pseudocode and real world case studies to demonstrate how each algorithm can be applied to a variety of scientific and engineering solutions World renowned researchers and practitioners in Metaheuristics present the procedures and pseudocode for creating a wide range of optimization algorithms Helps readers formulate and design the best optimization algorithms for their research goals through case studies in a variety of real world applications Helps readers understand the links between Metaheuristic algorithms and their application in Computational Intelligence Machine Learning and Deep Learning problems      *Information Technology for Manufacturing Systems* Qi Luo, 2010-01-12 Selected peer reviewed papers from the 2010 International Conference on Information

Technology for Manufacturing Systems ITMS 2010 Macao China Jan 30 31 2010 *Belgisch tijdschrift zekerheid* ,1999

Functional Materials and Advanced Technologies Marina Polyakova,2020-03-17 4th International Conference on Smart Materials Technologies 4th ICSMT and 4th International Conference on Advanced Functional Materials 4th ICAFM

**Metaheuristics in Water, Geotechnical and Transport Engineering** Xin-She Yang, Siamak Talatahari, Amir Hossein Alavi, 2012-12-31 Due to an ever decreasing supply in raw materials and stringent constraints on conventional energy sources demand for lightweight efficient and low cost structures has become crucially important in modern engineering design This requires engineers to search for optimal and robust design options to address design problems that are often large in scale and highly nonlinear making finding solutions challenging In the past two decades metaheuristic algorithms have shown promising power efficiency and versatility in solving these difficult optimization problems This book examines the latest developments of metaheuristics and their applications in water geotechnical and transport engineering offering practical case studies as examples to demonstrate real world applications Topics cover a range of areas within engineering including reviews of optimization algorithms artificial intelligence cuckoo search genetic programming neural networks multivariate adaptive regression swarm intelligence genetic algorithms ant colony optimization evolutionary multiobjective optimization with diverse applications in engineering such as behavior of materials geotechnical design flood control water distribution and signal networks This book can serve as a supplementary text for design courses and computation in engineering as well as a reference for researchers and engineers in metaheuristics optimization in civil engineering and computational intelligence Provides detailed descriptions of all major metaheuristic algorithms with a focus on practical implementation Develops new hybrid and advanced methods suitable for civil engineering problems at all levels Appropriate for researchers and advanced students to help to develop their work INFORMS Annual Meeting Institute for Operations Research and the Management Sciences. National Meeting, 2006 Metaheuristic Optimization Algorithms in Civil Engineering: New Applications Ali Kaveh, Armin Dadras Eslamlou, 2020-04-14 This book discusses the application of metaheuristic algorithms in a number of important optimization problems in civil engineering Advances in civil engineering technologies require greater accuracy efficiency and speed in terms of the analysis and design of the corresponding systems As such it is not surprising that novel methods have been developed for the optimal design of real world systems and models with complex configurations and large numbers of elements This book is intended for scientists engineers and students wishing to explore the potential of newly developed metaheuristics in practical problems It presents concepts that are not only applicable to civil engineering problems but can also be used for optimizing problems related to mechanical electrical and industrial engineering It is an essential resource for civil mechanical and electrical engineers who use optimization methods for design as well as for students and researchers interested in structural optimization

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