

Modeling and Optimization in Science and Technologies

Xin-She Yang
Gebrail Bekdaş
Sinan Melih Nigdeli *Editors*

Metaheuristics and Optimization in Civil Engineering

 Springer

Metaheuristics Optimization Engineering Modeling Technologies

**Kanak Kalita, Narayanan Ganesh, S.
Balamurugan**

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

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.

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 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.

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

Metaheuristics and Optimization in Computer and Electrical Engineering Navid Razmjoo, Noradin Ghadimi, Venkatesan Rajinikanth, 2023-10-07 This book discusses different methods of modifying the original metaheuristics and their application in computer and electrical engineering As the race to develop advanced technology accelerates a new era of metaheuristics has emerged Through researched based techniques and collaborative problem solving this book helps engineers to find efficient solutions to their engineering challenges With the help of an expert guide and the collective knowledge of the engineering community this comprehensive guide shows readers how to use machine learning and other AI techniques to reinvent smart engineering From understanding the fundamentals to mastering the latest metaheuristics models this guide provides with the skills and knowledge that need to stay ahead in the technology race In the previous volume authors focused on the application of original metaheuristics on electrical and computer sciences This volume learns how AI and modified metaheuristics can be used to optimize algorithms and create more efficient electrical engineering designs It gets insights on how data can be effectively processed and discover new techniques for creating sophisticated automation systems It maximizes the potential of readers computer and electrical engineering projects with powerful metaheuristics and optimization techniques

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

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

Materials and Technologies in Engineering Activity Guo Jian Chen, Haider F. Abdul Amir, Puneet Tandon, Poi Sim Khiew, 2016-08-17 Selected peer reviewed papers from the 2016 International Conference on Design Materials and Manufacturing March 25 27 2016 Kuala Lumpur Malaysia

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 **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.

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.

Belgisch tijdschrift zekerheid, 1999. *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. 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 metaheuristic 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

Metaheuristics-Based Materials Optimization Harbinder Singh, Shailendra Rajput, Abhishek Sharma, 2025-02-27
Metaheuristics Based Materials Optimization Enhancing Materials Applications provides a guide to using metaheuristics based computational techniques to improve the design performance and broaden the applications of various materials The book fuses optimization algorithms with materials engineering enabling more accurate simulations and models for analyzing and predicting the behavior of materials under different conditions allowing for design of materials with improved performance durability energy efficiency cost effectiveness and other desired characteristics Metaheuristic approaches for material synthesis and design structural optimization material characterization property prediction and process optimization are all covered as are comparisons of different algorithms step by step guidelines on how to implement them and case studies of them being applied in real world settings Provides a guide to using metaheuristics based computational techniques to improve the design performance and broaden the applications of various materials Presents real world case studies as well as commonly encountered problems and their solutions Allows for more accurate modeling better material design and development of materials tailored for specific applications

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