Evolutionary Computation And Optimization Algorithms In Software Engineering Applications And Techniques Premier Reference Source

This book constitutes the refereed proceedings of the 19th European Conference on Evolutionary Computation in Combinatorial Optimization, EvoCOP 2019, held as part of Evo* 2019, in Leipzig, Germany, in April 2019, co-located with the Evo* 2019 events EuroGP, EvoMUSART and EvoApplications. The 14 revised full papers presented were carefully reviewed and selected from 37 submissions. The papers cover a wide spectrum of topics, ranging from the foundations of evolutionary computation algorithms and other search heuristics to their accurate design and application to both single- and multi-objective combinatorial optimization problems. Fundamental and methodological aspects deal with runtime analysis, the structural properties of fitness landscapes, the study of metaheuristics core components, the clever design of their search

principles, and their careful selection and configuration. Applications cover domains such as scheduling, routing, partitioning and general graph problems.

This book presents examples of modern optimization algorithms. The focus is on a clear understanding of underlying studied problems, understanding described algorithms by a broad range of scientists and providing (computational) examples that a reader can easily repeat.

Evolutionary Algorithms (EAs) have grown into a mature field of research in optimization, and have proven to be effective and robust problem solvers for a broad range of static real-world optimization problems. Yet, since they are based on the principles of natural evolution, and since natural evolution is a dynamic process in a changing environment, EAs are also well suited to dynamic optimization problems. Evolutionary Optimization in Dynamic Environments is the first comprehensive work on the application of EAs to dynamic optimization problems. It provides an extensive survey on research in the area and shows how EAs can be successfully used to continuously and efficiently adapt a solution to a changing environment, find a good trade-off between solution quality and adaptation cost, find robust solutions whose quality is insensitive to changes in the

environment, find flexible solutions which are not only good but that can be easily adapted when necessary. All four aspects are treated in this book, providing a holistic view on the challenges and opportunities when applying EAs to dynamic optimization problems. The comprehensive and up-to-date coverage of the subject, together with details of latest original research, makes Evolutionary Optimization in Dynamic Environments an invaluable resource for researchers and professionals who are dealing with dynamic and stochastic optimization problems, and who are interested in applying local search heuristics, such as evolutionary algorithms.

This book constitutes the refereed proceedings of the 6th European Conference on Evolutionary Computation in Combinatorial Optimization, EvoCOP 2006, held in Budapest, Hungary in April 2006. The 24 revised full papers presented were carefully reviewed and selected from 77 submissions. The papers include coverage of evolutionary algorithms as well as various other metaheuristics, like scatter search, tabu search, and memetic algorithms.

Evolutionary computation algorithms are employed to minimize functions with large number of variables. Biogeography-based optimization (BBO) is an optimization algorithm that is based on the science of biogeography,

which researches the migration patterns of species. These migration paradigms provide the main logic behind BBO. Due to the cross-disciplinary nature of the optimization problems, there is a need to develop multiple approaches to tackle them and to study the theoretical reasoning behind their performance. This book explains the mathematical model of BBO algorithm and its variants created to cope with continuous domain problems (with and without constraints) and combinatorial problems.

Applications and Techniques

Evolutionary Optimization in Dynamic Environments

Data-Driven Evolutionary Optimization

Issues and Algorithms

Recent Developments in Discrete Optimization

Noise is a common factor in most real-world optimization problems. Sources of noise can include physical measurement limitations, stochastic simulation models, incomplete sampling of large spaces, and human-computer interaction. Evolutionary algorithms are general, nature-inspired heuristics for numerical search and optimization that are frequently observed to be particularly robust with regard to the effects of noise. Noisy Optimization with Evolution Strategies contributes to the understanding of

evolutionary optimization in the presence of noise by investigating the performance of evolution strategies, a type of evolutionary algorithm frequently employed for solving real-valued optimization problems. By considering simple noisy environments, results are obtained that describe how the performance of the strategies scales with both parameters of the problem and of the strategies considered. Such scaling laws allow for comparisons of different strategy variants, for tuning evolution strategies for maximum performance, and they offer insights and an understanding of the behavior of the strategies that go beyond what can be learned from mere experimentation. This first comprehensive work on noisy optimization with evolution strategies investigates the effects of systematic fitness overvaluation, the benefits of distributed populations, and the potential of genetic repair for optimization in the presence of noise. The relative robustness of evolution strategies is confirmed in a comparison with other direct search algorithms. Noisy Optimization with Evolution Strategies is an invaluable resource for researchers and practitioners of evolutionary algorithms.

This book introduces the new experimentalism in evolutionary computation, providing tools to understand algorithms and programs and their interaction with optimization problems. It develops and applies statistical

techniques to analyze and compare modern search heuristics such as evolutionary algorithms and particle swarm optimization. The book bridges the gap between theory and experiment by providing a self-contained experimental methodology and many examples.

This book constitutes the refereed proceedings of the 21st European Conference on Evolutionary Computation in Combinatorial Optimization, EvoCOP 2021, held as part of Evo*2021, as Virtual Event, in April 2021, co-located with the Evo*2021 events: EvoMUSART, EvoApplications, and EuroGP. The 14 revised full papers presented in this book were carefully reviewed and selected from 42 submissions. They cover a wide spectrum of topics, ranging from the foundations of evolutionary algorithms and other search heuristics to their accurate design and application to combinatorial optimization problems. Fundamental and methodological aspects deal with runtime analysis, the structural properties of fitness landscapes, the study of core components of metaheuristics, the clever design of their search principles, and their careful selection and configuration. Applications cover problem domains such as scheduling, routing, search-based software engineering and general graph problems. The range of topics covered in this volume reflects the current state of research in the fields of evolutionary computation and combinatorial optimization.

Estimation of Distribution Algorithms: A New Tool for Evolutionary Computation is devoted to a new paradigm for evolutionary computation, named estimation of distribution algorithms (EDAs). This new class of algorithms generalizes genetic algorithms by replacing the crossover and mutation operators with learning and sampling from the probability distribution of the best individuals of the population at each iteration of the algorithm. Working in such a way, the relationships between the variables involved in the problem domain are explicitly and effectively captured and exploited. This text constitutes the first compilation and review of the techniques and applications of this new tool for performing evolutionary computation. Estimation of Distribution Algorithms: A New Tool for Evolutionary Computation is clearly divided into three parts. Part I is dedicated to the foundations of EDAs. In this part, after introducing some probabilistic graphical models - Bayesian and Gaussian networks - a review of existing EDA approaches is presented, as well as some new methods based on more flexible probabilistic graphical models. A mathematical modeling of discrete EDAs is also presented. Part II covers several applications of EDAs in some classical optimization problems: the travelling salesman problem, the job scheduling problem, and the knapsack problem. EDAs are also applied to the optimization of some well-known combinatorial

and continuous functions. Part III presents the application of EDAs to solve some problems that arise in the machine learning field: feature subset selection, feature weighting in K-NN classifiers, rule induction, partial abductive inference in Bayesian networks, partitional clustering, and the search for optimal weights in artificial neural networks. Estimation of Distribution Algorithms: A New Tool for Evolutionary Computation is a useful and interesting tool for researchers working in the field of evolutionary computation and for engineers who face real-world optimization problems. This book may also be used by graduate students and researchers in computer science. `... I urge those who are interested in EDAs to study this well-crafted book today.' David E. Goldberg, University of Illinois Champaign-Urbana.

This book presents several recent advances on Evolutionary Computation, specially evolution-based optimization methods and hybrid algorithms for several applications, from optimization and learning to pattern recognition and bioinformatics. This book also presents new algorithms based on several analogies and metafores, where one of them is based on philosophy, specifically on the philosophy of praxis and dialectics. In this book it is also presented interesting applications on bioinformatics, specially the use of particle swarms to discover gene expression patterns in DNA microarrays.

Therefore, this book features representative work on the field of evolutionary computation and applied sciences. The intended audience is graduate, undergraduate, researchers, and anyone who wishes to become familiar with the latest research work on this field.

Evolutionary Computation for Modeling and Optimization

Evolutionary Algorithms

Theory of Evolutionary Computation

Evolutionary Computation

Techniques and Applications

A clear and comprehensive introduction to the field of evolutionary computation that takes an integrated approach. Evolutionary computation, the use of evolutionary systems as computational processes for solving complex problems, is a tool used by computer scientists and engineers who want to harness the power of evolution to build useful new artifacts, by biologists interested in developing and testing better models of natural evolutionary systems, and by artificial life scientists for designing and implementing new artificial evolutionary worlds. In this clear and comprehensive introduction to the field, Kenneth De Jong presents an integrated view of the state of the art in evolutionary computation. Although other books have described such particular areas of the field as genetic algorithms, genetic programming, evolution strategies, and evolutionary programming, Evolutionary Computation is noteworthy for considering these systems as specific instances of a more general class of evolutionary algorithms. This useful overview of a fragmented field is suitable for classroom use or as a reference for computer scientists and engineers.

This textbook provides a comprehensive introduction to nature-inspired metaheuristic methods for search

and optimization, including the latest trends in evolutionary algorithms and other forms of natural computing. Over 100 different types of these methods are discussed in detail. The authors emphasize non-standard optimization problems and utilize a natural approach to the topic, moving from basic notions to more complex ones. An introductory chapter covers the necessary biological and mathematical backgrounds for understanding the main material. Subsequent chapters then explore almost all of the major metaheuristics for search and optimization created based on natural phenomena, including simulated annealing, recurrent neural networks, genetic algorithms and genetic programming, differential evolution, memetic algorithms, particle swarm optimization, artificial immune systems, ant colony optimization, tabu search and scatter search, bee and bacteria foraging algorithms, harmony search, biomolecular computing, quantum computing, and many others. General topics on dynamic, multimodal, constrained, and multiobjective optimizations are also described. Each chapter includes detailed flowcharts that illustrate specific algorithms and exercises that reinforce important topics. Introduced in the appendix are some benchmarks for the evaluation of metaheuristics. Search and Optimization by Metaheuristics is intended primarily as a textbook for graduate and advanced undergraduate students specializing in engineering and computer science. It will also serve as a valuable resource for scientists and researchers working in these areas, as well as those who are interested in search and optimization methods.

Evolutionary algorithms are sophisticated search methods that have been found to be very efficient and effective in solving complex real-world multi-objective problems where conventional optimization tools fail to work well. Despite the tremendous amount of work done in the development of these algorithms in the past decade, many researchers assume that the optimization problems are deterministic and uncertainties are rarely examined. The primary motivation of this book is to provide a comprehensive introduction on the design and application of evolutionary algorithms for multi-objective optimization in the presence of

uncertainties. In this book, we hope to expose the readers to a range of optimization issues and concepts, and to encourage a greater degree of appreciation of evolutionary computation techniques and the exploration of new ideas that can better handle uncertainties. "Evolutionary Multi-Objective Optimization in Uncertain Environments: Issues and Algorithms" is intended for a wide readership and will be a valuable reference for engineers, researchers, senior undergraduates and graduate students who are interested in the areas of evolutionary multi-objective optimization and uncertainties.

This book provides a compilation on the state-of-the-art and recent advances of evolutionary computation for dynamic optimization problems. The motivation for this book arises from the fact that many real-world optimization problems and engineering systems are subject to dynamic environments, where changes occur over time. Key issues for addressing dynamic optimization problems in evolutionary computation, including fundamentals, algorithm design, theoretical analysis, and real-world applications, are presented. "Evolutionary Computation for Dynamic Optimization Problems" is a valuable reference to scientists, researchers, professionals and students in the field of engineering and science, particularly in the areas of computational intelligence, nature- and bio-inspired computing, and evolutionary computation.

This textbook is a second edition of Evolutionary Algorithms for Solving Multi-Objective Problems, significantly expanded and adapted for the classroom. The various features of multi-objective evolutionary algorithms are presented here in an innovative and student-friendly fashion, incorporating state-of-the-art research. The book disseminates the application of evolutionary algorithm techniques to a variety of practical problems. It contains exhaustive appendices, index and bibliography and links to a complete set of teaching tutorials, exercises and solutions.

Estimation of Distribution Algorithms

Classical and Evolutionary Algorithms in the Optimization of Optical Systems

Towards a New Evolutionary Computation

A Unified Approach

Multimodal Optimization by Means of Evolutionary Algorithms

This comprehensive reference text discusses evolutionary optimization techniques, to find optimal solutions for single and multi-objective problems. The text presents each evolutionary optimization algorithm along with its history and other working equations. It also discusses variants and hybrids of optimization techniques. The text presents step-by-step solution to a problem and includes software ' s like MATLAB and Python for solving optimization problems. It covers important optimization algorithms including single objective optimization, multi objective optimization, Heuristic optimization techniques, shuffled frog leaping algorithm, bacteria foraging algorithm and firefly algorithm. Aimed at senior undergraduate and graduate students in the field of electrical engineering, electronics engineering, mechanical engineering, and computer science and engineering, this text: Provides step-by-step solution for each evolutionary optimization algorithm. Provides flowcharts and graphics for better understanding of optimization techniques. Discusses popular optimization techniques include particle swarm optimization and genetic algorithm. Presents every optimization technique along with the history and working equations. Includes latest software like Python and MATLAB.

This book constitutes the refereed proceedings of the 7th European Conference on

Evolutionary Computation in Combinatorial Optimization, EvoCOP 2007, held in Valencia, Spain in April 2007. The 21 revised full papers presented were carefully reviewed and selected from 81 submissions. The papers cover evolutionary algorithms as well as various other metaheuristics, like scatter search, tabu search, memetic algorithms, variable neighborhood search, greedy randomized adaptive search procedures, ant colony optimization, and particle swarm optimization algorithms. The papers are specifically dedicat.

The optimization of optical systems is a very old problem. As soon as lens designers discovered the possibility of designing optical systems, the desire to improve those systems by the means of optimization began. For a long time the optimization of optical systems was connected with well-known mathematical theories of optimization which gave good results, but required lens designers to have a strong knowledge about optimized optical systems. In recent years modern optimization methods have been developed that are not primarily based on the known mathematical theories of optimization, but rather on analogies with nature. While searching for successful optimization methods, scientists noticed that the method of organic evolution (well-known Darwinian theory of evolution) represented an optimal strategy of adaptation of living organisms to their changing environment. If the method of organic evolution was very successful in nature, the principles of the biological evolution could be applied to the problem of optimization of complex technical systems.

The field of research covered by this book is niching/multimodal optimization, with an emphasis on evolutionary computation methods, explaining the state of the art and relating this research to a model-based view of the basin identification problem. The algorithms suggested by the author are compared to alternative recent methods on current benchmarks. This book is useful for researchers and practitioners in the area of evolutionary computing.

This book constitutes the refereed proceedings of the 5th European Conference on Evolutionary Computation in Combinatorial Optimization, EvoCOP 2005, held in Lausanne, Switzerland in March/April 2005. The 24 revised full papers presented were carefully reviewed and selected from 66 submissions. The papers cover evolutionary algorithms as well as related approaches like scatter search, simulated annealing, ant colony optimization, immune algorithms, variable neighborhood search, hyperheuristics, and estimation of distribution algorithms. The papers deal with representations, analysis of operators and fitness landscapes, and comparison algorithms. Among the combinatorial optimization problems studied are graph coloring, quadratic assignment, knapsack, graph matching, packing, scheduling, timetabling, lot-sizing, and the traveling salesman problem.

Search and Optimization by Metaheuristics

Evolutionary Multiobjective Optimization

Advances in Evolutionary Computing

Evolutionary Algorithms and Neural Networks

Evolutionary Multi-objective Optimization in Uncertain Environments

This book offers the first comprehensive taxonomy for multimodal optimization algorithms, work with its root in topics such as niching, parallel evolutionary algorithms, and global optimization. The author explains niching in evolutionary algorithms and its benefits; he examines their suitability for use as diagnostic tools for experimental analysis, especially for detecting problem (type) properties; and he measures and compares the performances of niching and canonical EAs using different benchmark test problem sets. His work consolidates the recent successes in this domain, presenting and explaining use cases, algorithms, and performance measures, with a focus throughout on the goals of the optimization processes and a deep understanding of the algorithms used. The book will be useful for researchers and practitioners in the area of computational intelligence, particularly those engaged with heuristic search, multimodal optimization, evolutionary computing, and experimental analysis.

Concentrates on developing intuition about evolutionary computation and problem solving skills and tool sets. Lots of applications and test problems, including a biotechnology chapter.

Metaheuristics have been shown to be e?ective for di?cult combinatorial op- mization problems appearing in a wide variety of industrial, economic, and sci- ti?c domains. Prominent examples of metaheuristics are evolutionary algorithms, tabu search, simulated annealing, scatter search, memetic algorithms, variable neighborhood search, iterated local search, greedy randomized adaptive search procedures, ant colony optimization, and

estimation of distribution algorithms. Problems solved successfully include scheduling, timetabling, network design, transportation and distribution, vehicle routing, the travelling salesman problem, packing and cutting, satis?ability, and general mixed integer programming. EvoCOP began in 2001 and has been held annually since then. It is the ?rst event speci?cally dedicated to the application of evolutionary computation and related methods to combinatorial optimization problems. Originally held as a workshop, EvoCOP became a conference in 2004. The events gave researchers an excellent opportunity to present their latest research and to discuss current - velopments and applications. Following the general trend of hybrid metaheur- tics and diminishing boundaries between the di?erent classes of metaheuristics, EvoCOP has broadened its scope in recent years and invited submissions on any kind of metaheuristic for combinatorial optimization.

This book introduces readers to the fundamentals of artificial neural networks, with a special emphasis on evolutionary algorithms. At first, the book offers a literature review of several well-regarded evolutionary algorithms, including particle swarm and ant colony optimization, genetic algorithms and biogeography-based optimization. It then proposes evolutionary version of several types of neural networks such as feed forward neural networks, radial basis function networks, as well as recurrent neural networks and multi-later perceptron. Most of the challenges that have to be addressed when training artificial neural networks using evolutionary algorithms are discussed in detail. The book also demonstrates the application of the proposed algorithms for several purposes such as classification, clustering, approximation, and prediction problems. It provides a tutorial on how to design, adapt, and evaluate artificial neural networks as well, and includes source

codes for most of the proposed techniques as supplementary materials.
Rapid advances in evolutionary computation have opened up a world of applications-a world rapidly growing and evolving. Decision making, neural networks, pattern recognition, complex optimization/search tasks, scheduling, control, automated programming, and cellular automata applications all rely on evolutionary computation. Evolutionary Computation presents the basic principles of evolutionary computing: genetic algorithms, evolution strategies, evolutionary programming, genetic programming, learning classifier systems, population models, and applications. It includes detailed coverage of binary and real encoding, including selection, crossover, and mutation, and discusses the (m+l) and (m,l) evolution strategy principles. The focus then shifts to applications: decision strategy selection, training and design of neural networks, several approaches to pattern recognition, cellular automata, applications of genetic programming, and more.
Optimization Algorithms
Meta-heuristic and Evolutionary Algorithms for Engineering Optimization
6th European Conference, EvoCOP 2006, Budapest, Hungary, April 10-12, 2006, Proceedings

5th European Conference, EvoCOP 2005, Lausanne, Switzerland, March 30 - April 1, 2005, Proceedings
This book provides a collection of fourty articles containing new material on both

theoretical aspects of Evolutionary Computing (EC), and demonstrating the usefulness/success of it for various kinds of large-scale real world problems. Around 23 articles deal with various theoretical aspects of EC and 17 articles demonstrate the success of EC methodologies. These articles are written by leading experts of the field from different countries all over the world.

This edited book reports on recent developments in the theory of evolutionary computation, or more generally the domain of randomized search heuristics. It starts with two chapters on mathematical methods that are often used in the analysis of randomized search heuristics, followed by three chapters on how to measure the complexity of a search heuristic: black-box complexity, a counterpart of classical complexity theory in black-box optimization; parameterized complexity, aimed at a more fine-grained view of the difficulty of problems; and the fixed-budget perspective, which answers the question of how good a solution will be after investing a certain computational budget. The book then describes theoretical results on three important questions in evolutionary computation: how to profit from changing the parameters during the run of an algorithm; how evolutionary algorithms cope with dynamically changing or stochastic environments; and how population diversity influences performance. Finally, the book looks at three algorithm classes that have only recently become

the focus of theoretical work: estimation-of-distribution algorithms; artificial immune systems; and genetic programming. Throughout the book the contributing authors try to develop an understanding for how these methods work, and why they are so successful in many applications. The book will be useful for students and researchers in theoretical computer science and evolutionary computing.

"This book presents applications of evolutionary computation in the software engineering field, including how evolutionary algorithms are used to solve different search and optimization problems in the area of software engineering"--Provided by publisher.

Evolutionary Multi-Objective Optimization is an expanding field of research. This book brings a collection of papers with some of the most recent advances in this field. The topic and content is currently very fashionable and has immense potential for practical applications and includes contributions from leading researchers in the field. Assembled in a compelling and well-organised fashion, Evolutionary Computation Based Multi-Criteria Optimization will prove beneficial for both academic and industrial scientists and engineers engaged in research and development and application of evolutionary algorithm based MCO. Packed with must-find information, this book is the first to comprehensively and clearly

address the issue of evolutionary computation based MCO, and is an essential read for any researcher or practitioner of the technique.

Evolutionary Computation and Optimization Algorithms in Software Engineering: Applications and Techniques lays the foundation for the successful integration of evolutionary computation into software engineering. It surveys techniques ranging from genetic algorithms, to swarm optimization theory, to ant colony optimization, demonstrating their uses and capabilities. These techniques are applied to aspects of software engineering such as software testing, quality assessment, reliability assessment, and fault prediction models, among others, to providing researchers, scholars and students with the knowledge needed to expand this burgeoning application.

Evolutionary Computation for Dynamic Optimization Problems

Theory and Applications

Evolutionary Computation and Optimization Algorithms in Software Engineering

Evolutionary Optimization

Hybrid Advanced Optimization Methods with Evolutionary Computation Techniques in Energy Forecasting

Evolutionary Optimization AlgorithmsJohn Wiley & Sons

Evolutionary computation techniques have attracted

increasing att- tions in recent years for solving complex optimization problems. They are more robust than traditional methods based on formal logics or mathematical programming for many real world OR/MS problems. E- lutionary computation techniques can deal with complex optimization problems better than traditional optimization techniques. However, most papers on the application of evolutionary computation techniques to Operations Research /Management Science (OR/MS) problems have scattered around in different journals and conference proceedings. They also tend to focus on a very special and narrow topic. It is the right time that an archival book series publishes a special volume which - cludes critical reviews of the state-of-art of those evolutionary com- tation techniques which have been found particularly useful for OR/MS problems, and a collection of papers which represent the latest devel- ment in tackling various OR/MS problems by evolutionary computation techniques. This special volume of the book series on Evolutionary - timization aims at filling in this

gap in the current literature. The special volume consists of invited papers written by leading - searchers in the field. All papers were peer reviewed by at least two recognised reviewers. The book covers the foundation as well as the practical side of evolutionary optimization. Evolutionary algorithms are bio-inspired algorithms based on Darwin's theory of evolution. They are expected to provide non-optimal but good quality solutions to problems whose resolution is impracticable by exact methods. In six chapters, this book presents the essential knowledge required to efficiently implement evolutionary algorithms. Chapter 1 describes a generic evolutionary algorithm as well as the basic operators that compose it. Chapter 2 is devoted to the solving of continuous optimization problems, without constraint. Three leading approaches are described and compared on a set of test functions. Chapter 3 considers continuous optimization problems with constraints. Various approaches suitable for evolutionary methods are presented. Chapter 4 is related to

combinatorial optimization. It provides a catalog of variation operators to deal with order-based problems. Chapter 5 introduces the basic notions required to understand the issue of multi-objective optimization and a variety of approaches for its application. Finally, Chapter 6 describes different approaches of genetic programming able to evolve computer programs in the context of machine learning.

This book is a printed edition of the Special Issue "Hybrid Advanced Optimization Methods with Evolutionary Computation Techniques in Energy Forecasting" that was published in Energies

Estimation of Distribution Algorithms (EDAs) are a set of algorithms in the Evolutionary Computation (EC) field characterized by the use of explicit probability distributions in optimization. Contrarily to other EC techniques such as the broadly known Genetic Algorithms (GAs) in EDAs, the crossover and mutation operators are substituted by the sampling of a distribution previously

learnt from the selected individuals. EDAs have experienced a high development that has transformed them into an established discipline within the EC field. This book attracts the interest of new researchers in the EC field as well as in other optimization disciplines, and that it becomes a reference for all of us working on this topic. The twelve chapters of this book can be divided into those that endeavor to set a sound theoretical basis for EDAs, those that broaden the methodology of EDAs and finally those that have an applied objective.

7th European Conference, EvoCOP 2007, Valencia, Spain, April 11-13, 2007, Proceedings

Examples

Evolutionary Optimization Algorithms

The New Experimentalism

Evolutionary Computation in Combinatorial Optimization

Computational optimization is an important paradigm with a wide range of applications. In virtually all branches of engineering and industry, we almost always try to optimize something - whether to

minimize the cost and energy consumption, or to maximize profits, outputs, performance and efficiency. In many cases, this search for optimality is challenging, either because of the high computational cost of evaluating objectives and constraints, or because of the nonlinearity, multimodality, discontinuity and uncertainty of the problem functions in the real-world systems. Another complication is that most problems are often NP-hard, that is, the solution time for finding the optimum increases exponentially with the problem size. The development of efficient algorithms and specialized techniques that address these difficulties is of primary importance for contemporary engineering, science and industry. This book consists of 12 self-contained chapters, contributed from worldwide experts who are working in these exciting areas. The book strives to review and discuss the latest developments concerning optimization and modelling with a focus on methods and algorithms for computational optimization. It also covers well-chosen, real-world applications in science, engineering and industry. Main topics include derivative-free optimization, multi-objective evolutionary algorithms, surrogate-based methods, maximum simulated likelihood estimation, support vector machines, and metaheuristic algorithms. Application case studies include aerodynamic shape optimization, microwave engineering, black-box optimization, classification, economics, inventory optimization and structural

optimization. This graduate level book can serve as an excellent reference for lecturers, researchers and students in computational science, engineering and industry.

This book presents an overview of archiving strategies developed over the last years by the authors that deal with suitable approximations of the sets of optimal and nearly optimal solutions of multi-objective optimization problems by means of stochastic search algorithms. All presented archivers are analyzed with respect to the approximation qualities of the limit archives that they generate and the upper bounds of the archive sizes. The convergence analysis will be done using a very broad framework that involves all existing stochastic search algorithms and that will only use minimal assumptions on the process to generate new candidate solutions. All of the presented archivers can effortlessly be coupled with any set-based multi-objective search algorithm such as multi-objective evolutionary algorithms, and the resulting hybrid method takes over the convergence properties of the chosen archiver. This book hence targets at all algorithm designers and practitioners in the field of multi-objective optimization.

Edited by professionals with years of experience, this book provides an introduction to the theory of evolutionary algorithms and single- and multi-objective optimization, and then goes on to discuss to

explore applications of evolutionary algorithms for many uses with real-world applications. Covering both the theory and applications of evolutionary computation, the book offers exhaustive coverage of several topics on nontraditional evolutionary techniques, details working principles of new and popular evolutionary algorithms, and discusses case studies on both scientific and real-world applications of optimization

Intended for researchers and practitioners alike, this book covers carefully selected yet broad topics in optimization, machine learning, and metaheuristics. Written by world-leading academic researchers who are extremely experienced in industrial applications, this self-contained book is the first of its kind that provides comprehensive background knowledge, particularly practical guidelines, and state-of-the-art techniques. New algorithms are carefully explained, further elaborated with pseudocode or flowcharts, and full working source code is made freely available. This is followed by a presentation of a variety of data-driven single- and multi-objective optimization algorithms that seamlessly integrate modern machine learning such as deep learning and transfer learning with evolutionary and swarm optimization algorithms. Applications of data-driven optimization ranging from aerodynamic design, optimization of industrial processes, to deep neural architecture search are included.

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 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 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 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 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.
Integrating Evolutionary Computation, Machine Learning and Data Science

Archiving Strategies for Evolutionary Multi-objective Optimization Algorithms

21st European Conference, EvoCOP 2021, Held as Part of EvoStar 2021, Virtual Event, April 7–9, 2021, Proceedings

A New Tool for Evolutionary Computation

Evolutionary Algorithms for Solving Multi-Objective Problems

A clear and lucid bottom-up approach to the basic principlesof evolutionary algorithms Evolutionary algorithms (EAs) are a type of artificialintelligence. EAs are motivated by optimization processes that weobserve in nature, such as natural selection, species migration,bird swarms, human culture, and ant colonies. This book discusses the theory, history, mathematics, andprogramming of evolutionary optimization algorithms. Featuredalgorithms include genetic algorithms, genetic programming, antcolony optimization, particle swarm optimization, differentialevolution, biogeography-based optimization, and many others. Evolutionary Optimization Algorithms: Provides a straightforward, bottom-up approach that assists

thereader in obtaining a clear–but theoreticallyrigorous–understanding of evolutionary algorithms, with anemphasis on implementation Gives a careful treatment of recently developedEAs–including opposition-based learning, artificial fishswarms, bacterial foraging, and many others– and discussestheir similarities and differences from more well-establishedEAs Includes chapter-end problems plus a solutions manual availableonline for instructors Offers simple examples that provide the reader with anintuitive understanding of the theory Features source code for the examples available on the author'swebsite Provides advanced mathematical techniques for analyzing EAs,including Markov modeling and dynamic system modeling Evolutionary Optimization Algorithms: Biologically Inspiredand Population-Based Approaches to Computer Intelligence is anideal text for advanced undergraduate students, graduate students,and professionals involved in engineering and computer science. Noisy Optimization With Evolution Strategies

Techniques and Algorithms Inspired by Nature
Experimental Research in Evolutionary Computation
Evolutionary Computation and Optimization Algorithms in Software Engineering: Applications and Techniques
9th European Conference, EvoCOP 2009, Tübingen, Germany, April 15-17, 2009, Proceedings