Particle Swarm Optimization For Muli Objective

The purpose of this book is to collect contributions that are at the intersection of multi-objective optimization, swarm intelligence (specifically, particle swarm optimization and ant colony optimization) and data mining.
This book focuses on the most well-regarded and recent nature-inspired algorithms capable of solving optimization problems with multiple objectives. Firstly, it provides preliminaries and essential definitions in multi-objective problems and different paradigms to solve them. It then presents an in-depth explanations of the theory, literature review, and applications of several widely-used algorithms, such as Multi-objective Particle Swarm Optimizer, Multi-Objective Genetic Algorithm and Multi-objective GreyWolf Optimizer Due to the simplicity of the techniques and flexibility, readers from any field of study can employ them for solving multi-objective optimization problem. The book provides the source codes for all the proposed algorithms on a dedicated webpage.
This book constitutes the refereed proceedings of the 8th International Conference on Evolutionary Multi-Criterion Optimization, EMO 2015 held in Guimarães, Portugal in March/April 2015. The 68 revised full papers presented together with 4 plenary talks were carefully reviewed and selected from 90 submissions. The EMO 2015 aims to continue these type of developments, being the papers presented focused in: theoretical aspects, algorithms development, many-objectives optimization, robustness and optimization under uncertainty, performance indicators, multiple criteria decision making and real-world applications.
This book reviews the literature on hand posture estimation using generative methods, identifying the current gaps, such as sensitivity to hand shapes, sensitivity to a good initial posture, difficult hand posture recovery in cases of loss in tracking, and lack of addressing multiple objectives to maximize accuracy and minimize computational cost. To fill these gaps, it proposes a new 3D hand model that combines the best features of the current 3D hand models in the literature. It also discusses the development of a hand shape optimization technique. To find the global optimum for the single-objective problem formulated, it improves and applies particle swarm optimization (PSO), one of the most highly regarded optimization algorithms and one that is used successfully in both science and industry. After formulating the problem, multi-objective particle swarm optimization (MOPSO) is employed to estimate the Pareto optimal front as the solution for this bi-objective problem. The book also demonstrates the effectiveness of the improved PSO in hand posture recovery in cases of tracking loss. Lastly, the book examines the formulation of hand posture estimation as a bi-objective problem for the first time. The case studies included feature 50 hand postures extracted from five standard datasets, and were used to benchmark the proposed 3D hand model, hand shape optimization, and hand posture recovery.
This book constitutes the refereed proceedings of the 5th International Conference on Evolutionary Multi-Criterion Optimization, EMO 2009, held in Nantes, France in April 2009. The 39 revised full papers presented together with 5 invited talks were carefully reviewed and selected from 72 submissions. The papers are organized in topical sections on theoretical analysis, uncertainty and noise, algorithm development, performance analysis and comparison, applications, MCDM Track, Many objectives, alternative methods, as well as EMO and MCDA.
This book presents part of the iM3F 2020 proceedings from the Mechatronics track. It highlights key challenges and recent trends in mechatronics engineering and technology that are non-trivial in the age of Industry 4.0. It discusses traditional as well as modern solutions that are employed in the multitude spectra of mechatronics-based applications. The readers are expected to gain an insightful view on the current trends, issues, mitigating factors as well as solutions from this book.
An exploratory analysis in low-dimensional objective space of the vector evaluated particle swarm optimization (VEPSO) algorithm is presented. A novel visualization technique is presented and applied to perform the exploratory analysis. The exploratory analysis together with a quantitative analysis revealed that the VEPSO algorithm continues to explore without exploiting the well-performing areas of the search space. A detailed investigation into the influence that the choice of archive implementation has on the performance of the VEPSO algorithm is presented. Both the Pareto-optimal front (POF) solution diversity and convergence towards the true POF is considered during the investigation. Attainment surfaces are investigated for their suitability in efficiently comparing two multi-objective optimization (MOO) algorithms. A new measure to objectively compare algorithms in multi-dimensional objective space, based on attainment surfaces, is presented. This measure, referred to as the porcupine measure, adapts the attainment surface measure by using a statistical test along with weighted intersection lines. Loosely based on the VEPSO algorithm, the multi-guided particle swarm optimization (MGPSO) algorithm is presented and evaluated. The results indicate that the MGPSO algorithm overcomes the weaknesses of the VEPSO algorithm and also outperforms a number of state of the art MOO algorithms on at least two benchmark test sets.
Cooperative, collaborating autonomous systems are at the forefront of research efforts in numerous disciplines across the applied sciences. There is constant progress in solution techniques for these systems. However, despite this progress, cooperating systems have continued to be extremely difficult to model, analyze, and solve. Theoretical results are very difficult to come by. Each year, the International Conference on Cooperative Control and Optimization (CCO) brings together top researchers from around the world to present new, cutting-edge, ideas, theories, applications, and advances in the fields of autonomous agents, cooperative systems, control theory, information flow, and optimization. The works in this volume are a result of invited papers and selected presentations at the Eighth Annual International Conference on Cooperative Control and Optimization, held in Gainesville, Florida, January 30 – February 1, 2008.
The Mission Routing Problem (MRP) is the selection of a vehicle path starting at a point, going through enemy terrain defended by radar sites to get to the target(s) and returning to a safe destination (usually the starting point). The MRP is a three-dimensional, multi-objective path search with constraints such as fuel expenditure, time limits, multi-targets, and radar sites with different levels of risks. It can severely task all the resources (people, hardware, software) of the system trying to compute the possible routes. The nature of the problem can cause operational planning systems to take longer to generate a solution than the time available. Since time is critical in MRP, it is important that a solution is reached within a relatively short time. It is not worth generating the solution if it takes days to calculate since the information may

become invalid during that time. Particle Swarm Optimization (PSO) is an Evolutionary Algorithm (EA) technique that tries to find optimal solutions to complex problems using particles that interact with each other. Both Particle Swarm Optimization (PSO) and the Ant System (AS) have been shown to provide good solutions to Traveling Salesman Problem (TSP). PSO_AS is a synthesis of PSO and Ant System (AS). PSO_AS is a new approach for solving the MRP, and it produces good solutions. This thesis presents a new algorithm (PSO_AS) that functions to find the optimal solution by exploring the MRP search space stochastically.

Multi-objective optimization (MO) is a fast-developing field in computational intelligence research. Giving decision makers more options to choose from using some post-analysis preference information, there are a number of competitive MO techniques with an increasingly large number of MO real-world applications. Multi-Objective Optimization in Computational Intelligence: Theory and Practice explores the theoretical, as well as empirical, performance of MOs on a wide range of optimization issues including combinatorial, real-valued, dynamic, and noisy problems. This book provides scholars, academics, and practitioners with a fundamental, comprehensive collection of research on multi-objective optimization techniques, applications, and practices.

Multi-objective optimization problems deal with finding a set of candidate optimal solutions to be presented to the decision maker. In industry, this could be the problem of finding alternative car designs given the usually conflicting objectives of performance, safety, environmental friendliness, ease of maintenance, price among others. Despite the significance of this problem, most of the non-evolutionary algorithms which are widely used cannot find a set of diverse and nearly optimal solutions due to the huge size of the search space. At the same time, the solution set produced by most of the currently used evolutionary algorithms lacks diversity. The present study investigates a new optimization method to solve multi-objective problems based on the widely used swarm-intelligence approach, Particle Swarm Optimization (PSO). Compared to other approaches, the proposed algorithm converges relatively fast while maintaining a diverse set of solutions. The investigated algorithm, Partially Informed Fuzzy-Dominance (PIFD) based PSO uses a dynamic network topology and fuzzy dominance to guide the swarm of dominated solutions. The proposed algorithm in this study has been tested on four benchmark problems and other real-world applications to ensure proper functionality and assess overall performance. The multi-objective gene regulatory network (GRN) problem entails the minimization of the coefficient of variation of modified photothermal units (MPTUs) across multiple sites along with the total sum of similarity background between ecotypes. The results throughout the current research study show that the investigated algorithm attains outstanding performance regarding optimization aspects, and exhibits rapid convergence and diversity.

A large international conference on Advances in Intelligent Control and Innovative Computing was held in Hong Kong, March March 16-18, 2011, under the auspices of the International MultiConference of Engineers and Computer Scientists (IMECS 2010). The IMECS is organized by the International Association of Engineers (IAENG). Intelligent Control and Computer Engineering contains 25 revised and extended research articles written by prominent researchers participating in the conference. Topics covered include artificial intelligence, control engineering, decision supporting systems, automated planning, automation systems, systems identification, modelling and simulation, communication systems, signal processing, and industrial applications. Intelligent Control and Innovative Computing offers the state of the art of tremendous advances in intelligent control and computer engineering and also serves as an excellent reference text for researchers and graduate students, working on intelligent control and computer engineering.

This book is intended to gather recent studies on particle swarm optimization (PSO). In this book, readers can find the recent theoretical developments and applications on PSO algorithm. From the theoretical aspect, PSO has preserved its popularity because of the fast convergence rate, and a lot of hybrid algorithms have recently been developed in order to increase the performance of the algorithm. At the same time, PSO has also been used to solve different kinds of engineering optimization problems. In this book, a reader can find engineering applications of PSO, such as environmental economic dispatch and grid computing.

This book constitutes the refereed proceedings of the 14th International Conference on Intelligent Data Engineering and Automated Learning, IDEAL 2013, held in Hefei, China, in October 2013. The 76 revised full papers presented were carefully reviewed and selected from more than 130 submissions. These papers provided a valuable collection of latest research outcomes in data engineering and automated learning, from methodologies, frameworks and techniques to applications. In addition to various topics such as evolutionary algorithms, neural networks, probabilistic modelling, swarm intelligent, multi-objective optimisation, and practical applications in regression, classification, clustering, biological data processing, text processing, video analysis, including a number of special sessions on emerging topics such as adaptation and learning multi-agent systems, big data, swarm intelligence and data mining, and combining learning and optimisation in intelligent data engineering.

This work is divided into a sequence of steps. The content of each step is described in chapters, and each chapter includes the work from basic information to the completion of some sequential step. The organization this work is as follows. In Chapter-1 some very basic introduction about the term optimization and also a brief introduction are given about optimization with single objective and multi objective optimization. Basic formulation of practical problems with multiple objectives as well as single objective in terms of mathematical programming problem is given. Further, some methods for solving MOOPs are discussed briefly which are present in the existing literature. Some classical methods based on the preference of a decision maker (DM) are categorized as no-preference, a priori preference, posteriori preferences and interactive preference are mentioned. Also some nature inspired methods based on the artificial intelligence are discussed like evolutionary algorithms. Concept of swarm intelligence and based methods like PSO, ACO, etc are given. In chapter-2, swarm intelligence based heuristic method particle swarm optimization method for solving multi objective optimization problems are given with position and velocity update equations. Swarm intelligent is the basic working idea on which this particular method and many other methods are based upon. In the ending of this chapter some applications of PSO in real world are given. In chapter-3, solving some multi objective optimization problems which are present in literature using PSO algorithm are solved. The results of these problems are noted and are presented below. Multiple iterations are performed in order to achieve the best possible results. Chapter-4 include conclusion of the whole work with future working scope and lastly, some references are mentioned.

This book explains the theoretical structure of particle swarm optimization (PSO) and focuses on the application of PSO to portfolio optimization problems. The general goal of portfolio optimization is to find a solution that provides the highest expected return at each level of portfolio risk. According to H. Markowitz's portfolio selection theory, as new assets are added to an investment portfolio, the total risk of the portfolio’s decreases depending on the correlations of asset returns, while the expected return on the portfolio represents the weighted average of the expected returns for each asset. The book explains PSO in detail and demonstrates how to implement Markowitz’s portfolio optimization approach using PSO. In addition, it expands on the Markowitz model and seeks to improve the solution-finding process with the aid of various algorithms. In short, the book provides researchers, teachers, engineers, managers and practitioners with many tools

they need to apply the PSO technique to portfolio optimization.
This book constitutes the refereed proceedings of the Third International Conference on Evolutionary Multi-Criterion Optimization, EMO 2005, held in Guanajuato, Mexico, in March 2005. The 59 revised full papers presented together with 2 invited papers and the summary of a tutorial were carefully reviewed and selected from the 115 papers submitted. The papers are organized in topical sections on algorithm improvements, incorporation of preferences, performance analysis and comparison, uncertainty and noise, alternative methods, and applications in a broad variety of fields.
What are the random-like phenomena that can be found everywhere in real-life world? When carrying out a random sampling survey on the traffic situation, we often obtain some descriptive results such as approximately expedite, a little crowded and so on, therefore, the average level should be regarded as the random fuzzy phenomenon, which is one of the random-like phenomena. Decision makers usually need to make the decision for these problems with random-like phenomena. Which model should be constructed for them? How should we handle these models to find the optimal strategy? How can we apply these models to solve real-life problems with random-like phenomena? In order to answer these questions, this book provides an up-to-date methodology system 5MRP for random-like multiple objective decision making, which includes problem system with random-like phenomena, model system with random-like coefficients, research system with random-like uncertain methods. Some practical applications are also provided to illustrate the effectiveness of the proposed methodology system. Researchers, practitioners and students in systems science, economics, mathematics, information, engineering and MS/OR will get a lot of useful references from this research monograph.
This two-volume set of LNCS 11643 and LNCS 11644 constitutes - in conjunction with the volume LNAI 11645 - the refereed proceedings of the 15th International Conference on Intelligent Computing, ICIC 2019, held in Nanchang, China, in August 2019. The 217 full papers of the three proceedings volumes were carefully reviewed and selected from 609 submissions. The ICIC theme unifies the picture of contemporary intelligent computing techniques as an integral concept that highlights the trends in advanced computational intelligence and bridges theoretical research with applications. The theme for this conference is “Advanced Intelligent Computing Methodologies and Applications.” Papers related to this theme are especially solicited, including theories, methodologies, and applications in science and technology.
"This book presents the most recent and established developments of Particle swarm optimization (PSO) within a unified framework by noted researchers in the field"--Provided by publisher.
This two-volume book presents outcomes of the 7th International Conference on Soft Computing for Problem Solving, SocProS 2017. This conference is a joint technical collaboration between the Soft Computing Research Society, Liverpool Hope University (UK), the Indian Institute of Technology Roorkee, the South Asian University New Delhi and the National Institute of Technology Silchar, and brings together researchers, engineers and practitioners to discuss thought-provoking developments and challenges in order to select potential future directions The book presents the latest advances and innovations in the interdisciplinary areas of soft computing, including original research papers in the areas including, but not limited to, algorithms (artificial immune systems, artificial neural networks, genetic algorithms, genetic programming, and particle swarm optimization) and applications (control systems, data mining and clustering, finance, weather forecasting, game theory, business and forecasting applications). It is a valuable resource for both young and experienced researchers dealing with complex and intricate real-world problems for which finding a solution by traditional methods is a difficult task.
For reasons both financial and environmental, there is a perpetual need to optimize the design and operating conditions of industrial process systems in order to improve their performance, energy efficiency, profitability, safety and reliability. However, with most chemical engineering application problems having many variables with complex inter-relationships, meeting these optimization objectives can be challenging. This is where Multi-Objective Optimization (MOO) is useful to find the optimal trade-offs among two or more conflicting objectives. This book provides an overview of the recent developments and applications of MOO for modeling, design and operation of chemical, petrochemical, pharmaceutical, energy and related processes. It then covers important theoretical and computational developments as well as specific applications such as metabolic reaction networks, chromatographic systems, CO2 emissions targeting for petroleum refining units, ecodesign of chemical processes, ethanol purification and cumene process design. Multi-Objective Optimization in Chemical Engineering: Developments and Applications is an invaluable resource for researchers and graduate students in chemical engineering as well as industrial practitioners and engineers involved in process design, modeling and optimization.
This book provides a new forum for the dissemination of knowledge in both theoretical and applied research on swarm intelligence (SI) and artificial neural network (ANN). It accelerates interaction between the two bodies of knowledge and fosters a unified development in the next generation of computational model for machine learning. To the best of our knowledge, the integration of SI and ANN is the first attempt to integrate various aspects of both the independent research area into a single volume.
These two volumes, LNCS 7076 and LNCS 7077, constitute the refereed proceedings of the Second International Conference on Swarm, Evolutionary, and Memetic Computing, SEMCCO 2011, held in Visakhapatnam, India, in December 2011. The 124 revised full papers presented in both volumes were carefully reviewed and selected from 422 submissions. The papers explore new application areas, feature new bio-inspired algorithms for solving specific hard optimization problems, and review the latest progresses in the cutting-edge research with swarm, evolutionary, and memetic computing in both theoretical and practical aspects.
Traditional optimization methods are no longer adequate to solve complex real life problems, as most of them involve nonlinear, discontinuous, non- differentiable, nonconvex, multiobjective functions with mixed variables in their model formulation. Over the last few years, the use of nature inspired meta-heuristic algorithms for systems optimization has increased tremendously, and "swarm intelligence and evolutionary computing techniques" are rapidly emerging as powerful tools for solving practical problems. This book describes efficient computational techniques based on Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO), Genetic Algorithm (GA) and Differential Evolution (DE) principles for single and multiple criterion optimization; and hybrid soft-computing techniques such as PSO Neural Network (PSO-NN), Adaptive Network Fuzzy Inference System (ANFIS) for hydrologic forecasting and demonstrates their applications to case studies in reservoir systems operation. This book is intended for people who are willing to learn new technology to solve complex real life problems and especially useful to professional in water resources field.
Swarm intelligence is an innovative computational way to solve hard problems. This discipline is inspired by the behaviour of social insect

(e.g. ants, termites, bees and wasps) colonies as well as fish schools and bird flocks. The content of this book is divided into two main parts: ant colony optimisation and particle swarm optimisation. The former describes systems that have been engineered using ant colony optimisation and the latter presents systems that were designed based on particle swarm optimisation.

"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.

Multiple small robots (swarms) can work together using Particle Swarm Optimization (PSO) to perform tasks that are difficult or impossible for a single robot to accomplish. The problem considered in this paper is exploration of an unknown environment with the goal of finding a target(s) at an unknown location(s) using multiple small mobile robots. This work demonstrates the use of a distributed PSO algorithm with a novel adaptive RSS weighting factor to guide robots for locating target(s) in high risk environments. The approach was developed and analyzed on multiple robot single and multiple target search. The approach was further enhanced by the multi-robot-multi-target search in noisy environments. The experimental results demonstrated how the availability of radio frequency signal can significantly affect robot search time to reach a target.

The purpose of this book is to collect contributions that deal with the use of nature inspired metaheuristics for solving multi-objective combinatorial optimization problems. Such a collection intends to provide an overview of the state-of-the-art developments in this field, with the aim of motivating more researchers in operations research, engineering, and computer science, to do research in this area. As such, this book is expected to become a valuable reference for those wishing to do research on the use of nature inspired metaheuristics for solving multi-objective combinatorial optimization problems.

This book covers the latest in multi-objective swarm intelligence and cooperative behavior. It contains innovative and intriguing applications as well as additions to the methodology and theory of genetic programming.

The aim of this book is to understand the state-of-the-art theoretical and practical advances of swarm intelligence. It comprises seven contemporary relevant chapters. In chapter 1, a review of Bacteria Foraging Optimization (BFO) techniques for both single and multiple criterions problem is presented. A survey on swarm intelligence for multiple and many objectives optimization is presented in chapter 2 along with a topical study on EEG signal analysis. Without compromising the extensive simulation study, a comparative study of variants of MOPSO is provided in chapter 3. Intractable problems like subset and job scheduling problems are discussed in chapters 4 and 7 by different hybrid swarm intelligence techniques. An attempt to study image enhancement by ant colony optimization is made in chapter 5. Finally, chapter 7 covers the aspect of uncertainty in data by hybrid PSO.

A distributed variant of multi-objective particle swarm optimization (MOPSO) called multi-objective parallel asynchronous particle swarm optimization (MOPAPSO) is presented, and the effects of distribution of objective function calculations to slave processors on the results and performance are investigated and employed for the synthesis of Grashof mechanisms. By using a formal multi-objective handling scheme based on Pareto dominance criteria, the need to pre-weight competing systemic objective functions is removed and the optimal solution for a design problem can be selected from a front of candidates after the parameter optimization has been completed. MOPAPSO's ability to match MOPSO's results using parallelization for improved performance is presented. Results for both four and ve bar mechanism synthesis examples are shown.

This book constitutes the refereed proceedings of the 8th International Conference on Parallel Problem Solving from Nature, PPSN 2004, held in Birmingham, UK, in September 2004. The 119 revised full papers presented were carefully reviewed and selected from 358 submissions. The papers address all current issues in biologically inspired computing; they are organized in topical sections on theoretical and foundational issues, new algorithms, applications, multi-objective optimization, co-evolution, robotics and multi-agent systems, and learning classifier systems and data mining.

The natural social behavior of large groups of animals, such as flocks of birds, schools of fish, or colonies of ants has fascinated scientists for hundreds of years, if not longer, due to the intricate nature of their interactions and their ability to move and work together seemingly effortlessly. Innovations and Developments of Swarm Intelligence Applications explores the emerging realm of swarm intelligence, which finds its basis in the natural social behavior of animals. The study and application of this swarm behavior has led scientists to a new world of research as ways are found to apply this behavior to independent intelligent agents, creating complex solutions for real world applications. Worldwide contributions have been seamlessly combined in this comprehensive reference, providing a wealth of new information for researchers, academicians, students, and engineers.