Parallel Problem Solving from Nature - PPSN XV

This book constitutes - in conjunction with the two-volume set LNCS 10954 and LNCS 10955 - the refereed proceedings of the 14th International Conference on Intelligent Computing, ICIC 2018, held in Wuhan, China, in August 2018. The 275 full papers and 72 short papers of the three proceedings volumes were carefully reviewed and selected from 632 submissions. The papers are organized in topical sections such as Evolutionary Computation and Learning; Neural Networks; Pattern Recognition; Image Processing; Information Security; Virtual Reality and Human-Computer Interaction; Business Intelligence and Multimedia Technology; Biomedical Informatics Theory and Methods; Swarm Intelligence and Optimization; Natural Computing; Quantum Computing; Intelligent Computing in Computer
Simulation-Driven Aerodynamic Design Using Variable-Fidelity Models

This book discusses surrogate modeling of high-frequency structures including antenna and microwave components. The focus is on constrained or performance-driven surrogates. The presented techniques aim at addressing the limitations of conventional modeling methods, pertinent to the issues of dimensionality and parameter ranges that need to be covered by the surrogate to ensure its design utility. Within performance-driven methodologies, mitigation of these problems is achieved through appropriate confinement of the model domain, focused on the regions promising from the point of view of the relevant design objectives. This enables the construction of reliable surrogates at a fraction of cost required by conventional methods, and to accomplish the modeling tasks where other techniques routinely fail. The book provides a broad selection of specific frameworks, extensively illustrated using examples of real-world microwave and antenna structures along with numerous design examples. Furthermore, the book contains introductory material on data-driven and physics-based surrogates. The book will be useful for the readers working in the area of high-frequency electronics, including microwave engineering, antenna design,
microwave photonics, magnetism, especially those that utilize electromagnetic (EM) simulation models in their daily routines. Covers performance-driven and constrained modeling methods, not available in other books to date; Discusses of a wide range of practical case studies including a variety of microwave and antenna structures; Includes design applications of the presented modeling frameworks, including single- and multi-objective parametric optimization.

**Computational Intelligence in Expensive Optimization Problems**

Nature-Inspired Computing Paradigms in Systems: Reliability, Availability, Maintainability, Safety and Cost (RAMS+C) and Prognostics and Health Management (PHM) covers several areas that include bioinspired techniques and optimization approaches for system dependability. The book addresses the issue of integration and interaction of the bioinspired techniques in system dependability computing so that intelligent decisions, design, and architectures can be supported. It brings together these emerging areas under the umbrella of bio- and nature-inspired computational intelligence. The primary audience of this book includes experts and developers who want to deepen their understanding of bioinspired computing in basic theory, algorithms, and applications. The book is also intended to be used as a textbook for masters and doctoral students who want to enhance their knowledge and understanding of the role of bioinspired techniques in system dependability. Provides the latest review Covers various nature-inspired techniques applied to RAMS+C and PHM problems Includes techniques applied to new applications

**Evolutionary Algorithms for Solving Multi-**
Objective Problems

This edited volume is devoted to the now-ubiquitous use of computational models across most disciplines of engineering and science, led by a trio of world-renowned researchers in the field. Focused on recent advances of modeling and optimization techniques aimed at handling computationally-expensive engineering problems involving simulation models, this book will be an invaluable resource for specialists (engineers, researchers, graduate students) working in areas as diverse as electrical engineering, mechanical and structural engineering, civil engineering, industrial engineering, hydrodynamics, aerospace engineering, microwave and antenna engineering, ocean science and climate modeling, and the automotive industry, where design processes are heavily based on CPU-heavy computer simulations. Various techniques, such as knowledge-based optimization, adjoint sensitivity techniques, and fast replacement models (to name just a few) are explored in-depth along with an array of the latest techniques to optimize the efficiency of the simulation-driven design process. High-fidelity simulation models allow for accurate evaluations of the devices and systems, which is critical in the design process, especially to avoid costly prototyping stages. Despite this and other advantages, the use of simulation tools in the design process is quite challenging due to associated high computational cost. The steady increase of available computational resources does not always translate into the shortening of the design cycle because of the growing demand for higher accuracy and necessity to simulate larger and more complex systems. For this reason, automated simulation-driven design—while highly desirable—is difficult when using conventional numerical optimization routines which normally require a large
number of system simulations, each one already expensive.

**18th European Symposium on Computer Aided Process Engineering**

Aerodynamic design, like many other engineering applications, is increasingly relying on computational power. The growing need for multi-disciplinarity and high fidelity in design optimization for industrial applications requires a huge number of repeated simulations in order to find an optimal design candidate. The main drawback is that each simulation can be computationally expensive – this becomes an even bigger issue when used within parametric studies, automated search or optimization loops, which typically may require thousands of analysis evaluations. The core issue of a design-optimization problem is the search process involved. However, when facing complex problems, the high-dimensionality of the design space and the high-multi-modality of the target functions cannot be tackled with standard techniques. In recent years, global optimization using meta-models has been widely applied to design exploration in order to rapidly investigate the design space and find sub-optimal solutions. Indeed, surrogate and reduced-order models can provide a valuable alternative at a much lower computational cost. In this context, this volume offers advanced surrogate modeling applications and optimization techniques featuring reasonable computational resources. It also discusses basic theory concepts and their application to aerodynamic design cases. It is aimed at researchers and engineers who deal with complex aerodynamic design problems on a daily basis and employ expensive simulations to solve them.
This two-volume set LNCS 11101 and 11102 constitutes the refereed proceedings of the 15th International Conference on Parallel Problem Solving from Nature, PPSN 2018, held in Coimbra, Portugal, in September 2018. The 79 revised full papers were carefully reviewed and selected from 205 submissions. The papers cover a wide range of topics in natural computing including evolutionary computation, artificial neural networks, artificial life, swarm intelligence, artificial immune systems, self-organizing systems, emergent behavior, molecular computing, evolutionary robotics, evolvable hardware, parallel implementations and applications to real-world problems. The papers are organized in the following topical sections: numerical optimization; combinatorial optimization; genetic programming; multi-objective optimization; parallel and distributed frameworks; runtime analysis and approximation results; fitness landscape modeling and analysis; algorithm configuration, selection, and benchmarking; machine learning and evolutionary algorithms; and applications. Also included are the descriptions of 23 tutorials and 6 workshops which took place in the framework of PPSN XV.

Metaheuristics in Machine Learning: Theory and Applications

Contemporary engineering design is heavily based on computer simulations. Accurate, high-fidelity simulations are used not only for design verification but, even more importantly, to adjust parameters of the system to have it meet given performance requirements. Unfortunately, accurate simulations are often computationally very expensive with evaluation times as long as hours or even days per design, making design automation using conventional methods impractical. These and other
problems can be alleviated by the development and employment of so-called surrogates that reliably represent the expensive, simulation-based model of the system or device of interest but they are much more reasonable and analytically tractable. This volume features surrogate-based modeling and optimization techniques, and their applications for solving difficult and computationally expensive engineering design problems. It begins by presenting the basic concepts and formulations of the surrogate-based modeling and optimization paradigm and then discusses relevant modeling techniques, optimization algorithms and design procedures, as well as state-of-the-art developments. The chapters are self-contained with basic concepts and formulations along with applications and examples. The book will be useful to researchers in engineering and mathematics, in particular those who employ computationally heavy simulations in their design work.

Proceedings of the Fifth International Scientific Conference “Intelligent Information Technologies for Industry” (IITI’21)

Incorporation of a priori knowledge, such as expert knowledge, meta-heuristics and human preferences, as well as domain knowledge acquired during evolutionary search, into evolutionary algorithms has received increasing interest in the recent years. It has been shown from various motivations that knowledge incorporation into evolutionary search is able to significantly improve search efficiency. However, results on knowledge incorporation in evolutionary computation have been scattered in a wide range of research areas and a systematic handling of this important topic in evolutionary computation still lacks. This edited book is a first attempt
to put together the state-of-art and recent advances on knowledge incorporation in evolutionary computation within a unified framework. Existing methods for knowledge incorporation are divided into the following five categories according to the functionality of the incorporated knowledge in the evolutionary algorithms. 1. Knowledge incorporation in representation, population initialization, - combination and mutation. 2. Knowledge incorporation in selection and reproduction. 3. Knowledge incorporation in fitness evaluations. 4. Knowledge incorporation through life-time learning and human-computer interactions. 5. Incorporation of human preferences in multi-objective evolutionary computation. The intended readers of this book are graduate students, researchers and practitioners in all fields of science and engineering who are interested in evolutionary computation. The book is divided into six parts. Part I contains one introductory chapter titled "A selected introduction to evolutionary computation" by Yao, which presents a concise but insightful introduction to evolutionary computation.

**Smart Innovations in Communication and Computational Sciences**

Nature-inspired computation and swarm intelligence have become popular and effective tools for solving problems in optimization, computational intelligence, soft computing and data science. Recently, the literature in the field has expanded rapidly, with new algorithms and applications emerging. Nature-Inspired Computation and Swarm Intelligence: Algorithms, Theory and Applications is a timely reference giving a comprehensive review of relevant state-of-the-art developments in algorithms, theory and applications of nature-inspired algorithms and swarm intelligence. It reviews and documents the new
developments, focusing on nature-inspired algorithms and their theoretical analysis, as well as providing a guide to their implementation. The book includes case studies of diverse real-world applications, balancing explanation of the theory with practical implementation. Nature-Inspired Computation and Swarm Intelligence: Algorithms, Theory and Applications is suitable for researchers and graduate students in computer science, engineering, data science, and management science, who want a comprehensive review of algorithms, theory and implementation within the fields of nature inspired computation and swarm intelligence. Introduces nature-inspired algorithms and their fundamentals, including: particle swarm optimization, bat algorithm, cuckoo search, firefly algorithm, flower pollination algorithm, differential evolution and genetic algorithms as well as multi-objective optimization algorithms and others Provides a theoretical foundation and analyses of algorithms, including: statistical theory and Markov chain theory on the convergence and stability of algorithms, dynamical system theory, benchmarking of optimization, no-free-lunch theorems, and a generalized mathematical framework Includes a diversity of case studies of real-world applications: feature selection, clustering and classification, tuning of restricted Boltzmann machines, travelling salesman problem, classification of white blood cells, music generation by artificial intelligence, swarm robots, neural networks, engineering designs and others

Simulation-Driven Modeling and Optimization

The present book includes a set of selected extended papers from the 4th International Conference on Simulation and Modeling Methodologies, Technologies and Applications (SIMULTECH 2014), held in Vienna,
Austria, from 28 to 30 August 2014. The conference brought together researchers, engineers and practitioners interested in methodologies and applications of modeling and simulation. New and innovative solutions are reported in this book. SIMULTECH 2014 received 167 submissions, from 45 countries, in all continents. After a double blind paper review performed by the Program Committee, 23% were accepted as full papers and thus selected for oral presentation. Additional papers were accepted as short papers and posters. A further selection was made after the Conference, based also on the assessment of presentation quality and audience interest, so that this book includes the extended and revised versions of the very best papers of SIMULTECH 2014. Commitment to high quality standards is a major concern of SIMULTECH that will be maintained in the next editions, considering not only the stringent paper acceptance ratios but also the quality of the program committee, keynote lectures, participation level and logistics.

**Handbook of Thin Films, Five-Volume Set**

Computer simulations is a fundamental tool of the design process in many engineering disciplines including aerospace engineering. However, although high-fidelity numerical models are accurate, they can be computationally expensive with evaluation time for a single design as long as hours, days or even weeks. Simulation-driven design using conventional optimization techniques may be therefore prohibitive. This book explores the alternative: performing computationally efficient design using surrogate-based optimization, where the high-fidelity model is replaced by its computationally cheap but still reasonably accurate representation: a surrogate. The emphasis is on physics-based surrogates. Application-wise, the focus is on
aerodynamics and the methods and techniques described in the book are demonstrated using aerodynamic shape optimization cases. Applications in other engineering fields are also demonstrated. State-of-the-art techniques and a depth of coverage never published before make this a unique and essential book for all researchers working in aerospace and other engineering areas and dealing with optimization, computationally expensive design problems, and simulation-driven design. Contents:

Motivation and Problem Formulation: Introduction

Aerodynamic Shape Optimization

Optimization Techniques: Simulation-Driven Design: Direct Methods

Surrogate-Based Optimization

SBO with Approximation-Based Surrogates

SBO with Physics-Based Surrogates

Aerodynamics Modeling: Geometry Parameterization

High-Fidelity Aerodynamic Models

Low-Fidelity Aerodynamics Models

Applications:

Transonic Airfoil Shape Design

Transonic Wing Shape Design

Subsonic Shape Design

Selected Applications of Surrogate-Based Optimization in Other Areas

Surrogate-Based Optimization with MATLAB

Conclusion: Practical Aspects of Variable-Fidelity Design

Readership: Graduate students and researchers in the field of engineering, in particular, aerospace engineering.

Key Features:

- Gathers a number of relevant techniques that were never compiled in one publication before, and certain state-of-the-art techniques have never been published in book form.
- Compact and self-contained introduction to the area of surrogate-based optimization and variable-fidelity optimization.
- At present, this is the only book available on the market that offers coverage of variable-fidelity optimization methods.

Keywords:

- Aerodynamic Shape Optimization
- Computational Fluid Dynamics (CFD)
- Surrogate Modeling
- Surrogate-based Optimization
- Variable-fidelity Simulations
- Simulation-driven Design
Fractional Order Systems

The book explains the finite element method with various engineering applications to help students, teachers, engineers and researchers. It explains mathematical modeling of engineering problems and approximate methods of analysis and different approaches.

Analysis and Design of Nonlinear Systems in the Frequency Domain

During recent years a great deal of interest has been devoted to large scale computing applications. This has occurred in great part because of the introduction of advanced high performance computer architectures. The book contains survey articles as well as chapters on specific research applications, development and analysis of numerical algorithms, and performance evaluation of algorithms on advanced architectures. The effect of specialized architectural features on the performance of large scale computation is also considered by several authors. Several areas of applications are represented, including the numerical solution of partial differential equations, iterative techniques for large structured problems, the numerical solution of boundary value problems for ordinary differential equations, numerical optimization, and numerical quadrature. Mathematical issues in computer architecture are also presented, including the description of grey codes for generalized hypercubes. The results presented in this volume give, in our opinion, a representative picture of today’s state of the art in several aspects of large scale computing.

Surrogate-Based Modeling and Optimization

This book addresses computationally-efficient multi-
objective optimization of antenna structures using variable-fidelity electromagnetic simulations, surrogate modeling techniques, and design space reduction methods. Based on contemporary research, it formulates multi-objective design tasks, highlights related challenges in the context of antenna design, and discusses solution approaches. Specific focus is on providing methodologies for handling computationally expensive simulation models of antenna structures in the sense of their multi-objective optimization. Also given is a summary of recent developments in antenna design optimization using variable-fidelity simulation models. Numerous examples of real-world antenna design problems are provided along with discussions and recommendations for the readers interested in applying the considered methods in their design work. Written with researchers and students in mind, topics covered can also be applied across a broad spectrum of aeronautical, mechanical, electrical, biomedical and civil engineering. It is of particular interest to those dealing with optimization, computationally expensive design tasks and simulation-driven design.

**Knowledge Incorporation in Evolutionary Computation**

The six-volume set LNCS 12742, 12743, 12744, 12745, 12746, and 12747 constitutes the proceedings of the 21st International Conference on Computational Science, ICCS 2021, held in Krakow, Poland, in June 2021.* The total of 260 full papers and 57 short papers presented in this book set were carefully reviewed and selected from 635 submissions. 48 full and 14 short papers were accepted to the main track from 156 submissions; 212 full and 43 short papers were accepted to the workshops/thematic tracks from 479 submissions. The papers were organized
Simulation-Driven Design by Knowledge-Based Response Correction Techniques
This book discusses various aspects of real-world applications of optimization algorithms, presenting insights from the 5th International Conference on Harmony Search, Soft Computing and Applications, held at Kunming, China on July 20–22, 2019. The book focuses on the recent advances in soft computing techniques such as harmony search, PSO and DE and their application to solve engineering problems. Presenting research on various real-world engineering problems concerning crowd evacuation strategies, adaptive learning systems, economic impact analysis, cyber-attack detection, urban drainage systems, water management models, feature selection and inventory systems, it is a valuable resource for researchers wanting a state-of-the-art overview of the latest advances in soft computing and related areas.

Nature-Inspired Computing Paradigms in Systems

COMMUNICATION NETWORKS AND SERVICE MANAGEMENT IN THE ERA OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING Discover the impact that new technologies are having on communication systems with this up-to-date and one-stop resource Communication Networks and Service Management in the Era of Artificial Intelligence and Machine Learning delivers a comprehensive overview of the impact of artificial intelligence (AI) and machine learning (ML) on service and network management. Beginning with a fulsome description of ML and AI, the book moves on to discuss management models, architectures, and frameworks. The authors also explore how AI and ML can be used in service management functions like the generation of workload profiles, service provisioning, and more. The book includes a handpicked selection of applications and case studies, as well as a
treatment of emerging technologies the authors predict could have a significant impact on network and service management in the future. Statistical analysis and data mining are also discussed, particularly with respect to how they allow for an improvement of the management and security of IT systems and networks. Readers will also enjoy topics like: A thorough introduction to network and service management, machine learning, and artificial intelligence An exploration of artificial intelligence and machine learning for management models, including autonomic management, policy-based management, intent based management, and network virtualization-based management Discussions of AI and ML for architectures and frameworks, including cloud systems, software defined networks, 5G and 6G networks, and Edge/Fog networks An examination of AI and ML for service management, including the automatic generation of workload profiles using unsupervised learning Perfect for information and communications technology educators, Communication Networks and Service Management in the Era of Artificial Intelligence and Machine Learning will also earn a place in the libraries of engineers and professionals who seek a structured reference on how the emergence of artificial intelligence and machine learning techniques is affecting service and network management.

**Simulation and Modeling Methodologies, Technologies and Applications**

This book constitutes the thoroughly refereed post-conference proceedings of the 6th International Conference on Learning and Intelligent Optimization, LION 6, held in Paris, France, in January 2012. The 23 long and 30 short revised papers were carefully reviewed and selected from a total of 99 submissions. The papers focus on the intersections and uncharted territories
between machine learning, artificial intelligence, mathematical programming and algorithms for hard optimization problems. In addition to the paper contributions the conference also included 3 invited speakers, who presented forefront research results and frontiers, and 3 tutorial talks, which were crucial in bringing together the different components of LION community.

Transactions on Computational Science XXXVIII

Computational complexity is a serious bottleneck for the design process in virtually any engineering area. While migration from prototyping and experimental-based design validation to verification using computer simulation models is inevitable and has a number of advantages, high computational costs of accurate, high-fidelity simulations can be a major issue that slows down the development of computer-aided design methodologies, particularly those exploiting automated design improvement procedures, e.g., numerical optimization. The continuous increase of available computational resources does not always translate into shortening of the design cycle because of the growing demand for higher accuracy and necessity to simulate larger and more complex systems. Accurate simulation of a single design of a given system may be as long as several hours, days or even weeks, which often makes design automation using conventional methods impractical or even prohibitive. Additional problems include numerical noise often present in the simulation data, possible presence of multiple locally optimum designs, as well as multiple conflicting objectives. In this edited book, various techniques that can alleviate solving computationally expensive engineering design problems are presented. One of the
most promising approaches is the use of fast replacement models, so-called surrogates, that reliably represent the expensive, simulation-based model of the system/device of interest but they are much cheaper and analytically tractable. Here, a group of international experts summarize recent developments in the area and demonstrate applications in various disciplines of engineering and science. The main purpose of the work is to provide the basic concepts and formulations of the surrogate-based modeling and optimization paradigm, as well as discuss relevant modeling techniques, optimization algorithms and design procedures. Therefore, this book should be useful to researchers and engineers from any discipline where computationally heavy simulations are used on daily basis in the design process.

**Nature-Inspired Computation and Swarm Intelligence**

This book is a collection of the most recent approaches that combine metaheuristics and machine learning. Some of the methods considered in this book are evolutionary, swarm, machine learning, and deep learning. The chapters were classified based on the content; then, the sections are thematic. Different applications and implementations are included; in this sense, the book provides theory and practical content with novel machine learning and metaheuristic algorithms. The chapters were compiled using a scientific perspective. Accordingly, the book is primarily intended for undergraduate and postgraduate students of Science, Engineering, and Computational Mathematics and is useful in courses on Artificial Intelligence, Advanced Machine Learning, among others. Likewise, the book is useful for research from the evolutionary computation, artificial intelligence,
Learning and Intelligent Optimization

Fractional Order Systems: Optimization, Control, Circuit Realizations and Applications consists of 21 contributed chapters by subject experts. Chapters offer practical solutions and novel methods for recent research problems in the multidisciplinary applications of fractional order systems, such as FPGA, circuits, memristors, control algorithms, photovoltaic systems, robot manipulators, oscillators, etc. This book is ideal for researchers working in the modeling and applications of both continuous-time and discrete-time dynamics and chaotic systems.

Researchers from academia and industry who are working in research areas such as control engineering, electrical engineering, mechanical engineering, computer science, and information technology will find the book most informative. Discusses multi-disciplinary applications with new fundamentals, modeling, analysis, design, realization and experimental results Includes new circuits and systems based on the new nonlinear elements Covers most of the linear and nonlinear fractional-order theorems that will solve many scientific issues for researchers Closes the gap between theoretical approaches and real-world applications Provides MATLAB® and Simulink code for many of the applications in the book

Communication Networks and Service Management in the Era of Artificial Intelligence and Machine Learning

Focused on efficient simulation-driven multi-fidelity optimization techniques, this monograph on simulation-driven optimization covers simulations utilizing physics-based low-fidelity models, often based on coarse-
discretization simulations or other types of simplified physics representations, such as analytical models. The methods presented in the book exploit as much as possible any knowledge about the system or device of interest embedded in the low-fidelity model with the purpose of reducing the computational overhead of the design process. Most of the techniques described in the book are of response correction type and can be split into parametric (usually based on analytical formulas) and non-parametric, i.e., not based on analytical formulas. The latter, while more complex in implementation, tend to be more efficient. The book presents a general formulation of response correction techniques as well as a number of specific methods, including those based on correcting the low-fidelity model response (output space mapping, manifold mapping, adaptive response correction and shape-preserving response prediction), as well as on suitable modification of design specifications. Detailed formulations, application examples and the discussion of advantages and disadvantages of these techniques are also included. The book demonstrates the use of the discussed techniques for solving real-world engineering design problems, including applications in microwave engineering, antenna design, and aero/hydrodynamics.

**Computational Science and Its Applications - ICCSA 2021**

The book provides insights into International Conference on Smart Innovations in Communications and Computational Sciences (ICSICCS 2017) held at North West Group of Institutions, Punjab, India. It presents new advances and research results in the fields of computer and communication written by leading researchers, engineers and scientists in the domain of interest from around the world. The book includes research work in all
the areas of smart innovation, systems and technologies, embedded knowledge and intelligence, innovation and sustainability, advance computing, networking and informatics. It also focuses on the knowledge-transfer methodologies and innovation strategies employed to make this happen effectively. The combination of intelligent systems tools and a broad range of applications introduce a need for a synergy of disciplines from science and technology. Sample areas include, but are not limited to smart hardware, software design, smart computing technologies, intelligent communications and networking, web and informatics and computational sciences.

Artificial Intelligence and Applied Mathematics in Engineering Problems

The 18th European Symposium on Computer Aided Process Engineering contains papers presented at the 18th European Symposium of Computer Aided Process Engineering (ESCAPE 18) held in Lyon, France, from 1-4 June 2008. The ESCAPE series brings the latest innovations and achievements by leading professionals from the industrial and academic communities. The series serves as a forum for engineers, scientists, researchers, managers and students from academia and industry to: - present new computer aided methods, algorithms, techniques related to process and product engineering, - discuss innovative concepts, new challenges, needs and trends in the area of CAPE. This research area bridges fundamental sciences (physics, chemistry, thermodynamics, applied mathematics and computer sciences) with the various aspects of process and product engineering. The special theme for ESCAPE-18 is CAPE for the Users! CAPE systems are to be put in the hands of end users who need functionality and assistance beyond the scientific and technological capacities which are at the
core of the systems. The four main topics are: - off-line systems for synthesis and design, - on-line systems for control and operation, - computational and numerical solutions strategies, - integrated and multi-scale modelling and simulation, Two general topics address the impact of CAPE tools and methods on Society and Education. * CD-ROM that accompanies the book contains all research papers and contributions * International in scope with guest speeches and keynote talks from leaders in science and industry * Presents papers covering the latest research, key top areas and developments in Computer Aided Process Engineering

**Grid Computing: Software Environments and Tools**

The main objective of this book is to provide the necessary background to work with big data by introducing some novel optimization algorithms and codes capable of working in the big data setting as well as introducing some applications in big data optimization for both academics and practitioners interested, and to benefit society, industry, academia, and government. Presenting applications in a variety of industries, this book will be useful for the researchers aiming to analyses large scale data. Several optimization algorithms for big data including convergent parallel algorithms, limited memory bundle algorithm, diagonal bundle method, convergent parallel algorithms, network analytics, and many more have been explored in this book.

**Multi-objective Design Of Antennas Using Surrogate Models**

This five-volume handbook focuses on processing techniques, characterization methods, and physical
properties of thin films (thin layers of insulating, conducting, or semiconductor material). The editor has composed five separate, thematic volumes on thin films of metals, semimetals, glasses, ceramics, alloys, organics, diamonds, graphites, porous materials, noncrystalline solids, supramolecules, polymers, copolymers, biopolymers, composites, blends, activated carbons, intermetallics, chalcogenides, dyes, pigments, nanostructured materials, biomaterials, inorganic/polymer composites, organoceramics, metallocenes, disordered systems, liquid crystals, quasicrystals, and layered structures. Thin films is a field of the utmost importance in today's materials science, electrical engineering and applied solid state physics; with both research and industrial applications in microelectronics, computer manufacturing, and physical devices. Advanced, high-performance computers, high-definition TV, digital camcorders, sensitive broadband imaging systems, flat-panel displays, robotic systems, and medical electronics and diagnostics are but a few examples of miniaturized device technologies that depend the utilization of thin film materials. The Handbook of Thin Films Materials is a comprehensive reference focusing on processing techniques, characterization methods, and physical properties of these thin film materials.

Performance-Driven Surrogate Modeling of High-Frequency Structures

In modern science and engineering, laboratory experiments are replaced by high fidelity and computationally expensive simulations. Using such simulations reduces costs and shortens development times but introduces new challenges to design optimization process. Examples of such challenges include limited computational resource for simulation runs,
complicated response surface of the simulation inputs-outputs, and etc. Under such difficulties, classical optimization and analysis methods may perform poorly. This motivates the application of computational intelligence methods such as evolutionary algorithms, neural networks and fuzzy logic, which often perform well in such settings. This is the first book to introduce the emerging field of computational intelligence in expensive optimization problems. Topics covered include: dedicated implementations of evolutionary algorithms, neural networks and fuzzy logic, reduction of expensive evaluations (modelling, variable-fidelity, fitness inheritance), frameworks for optimization (model management, complexity control, model selection), parallelization of algorithms (implementation issues on clusters, grids, parallel machines), incorporation of expert systems and human-system interface, single and multiobjective algorithms, data mining and statistical analysis, analysis of real-world cases (such as multidisciplinary design optimization). The edited book provides both theoretical treatments and real-world insights gained by experience, all contributed by leading researchers in the respective fields. As such, it is a comprehensive reference for researchers, practitioners, and advanced-level students interested in both the theory and practice of using computational intelligence for expensive optimization problems.

**Finite Element Method with Applications in Engineering:**

This book constitutes the refereed proceedings of the Third Australasian Conference on Artificial Life and Computational Intelligence, ACALCI 2017, held in Geelong, VIC, Australia, in January/February 2017. The 32 papers presented in this volume were carefully reviewed...
and selected from 47 submissions. They were organized in topical sections named: artificial life and computational intelligence and optimization algorithms and applications.

**Scientific Computing with MATLAB**

This book focuses on the development of three novel approaches to build up a framework for the frequency domain analysis and design of nonlinear systems. The concepts are derived from Volterra series representation of nonlinear systems which are described by nonlinear difference or differential equations. Occupying the middle ground between traditional linear approaches and more complex nonlinear system theories, the book will help readers to have a good start to analyse and exploit the nonlinearities. Analysis and Design of Nonlinear Systems in the Frequency Domain provides clear illustrations and examples at the beginning and the end of each chapter, respectively, making it of interest to both academics and practicing engineers.

**Application of Surrogate-based Global Optimization to Aerodynamic Design**

The book focuses on soft computing and its applications to solve real-world problems occurring in different domains ranging from medicine and healthcare, and supply chain management to image processing and cryptanalysis. It includes high-quality papers presented in the International Conference on Soft Computing: Theories and Applications (SoCTA 2017), organized by Bundelkhand University, Jhansi, India. Offering significant insights into soft computing for teachers and researchers alike, the book inspires more researchers to work in the field of soft computing.
Solving Computationally Expensive Engineering Problems

This book highlights essential concepts in connection with the traditional bat algorithm and its recent variants, as well as its application to find optimal solutions for a variety of real-world engineering and medical problems. Today, swarm intelligence-based meta-heuristic algorithms are extensively being used to address a wide range of real-world optimization problems due to their adaptability and robustness. Developed in 2009, the bat algorithm (BA) is one of the most successful swarm intelligence procedures, and has been used to tackle optimization tasks for more than a decade. The BA’s mathematical model is quite straightforward and easy to understand and enhance, compared to other swarm approaches. Hence, it has attracted the attention of researchers who are working to find optimal solutions in a diverse range of domains, such as N-dimensional numerical optimization, constrained/unconstrained optimization and linear/nonlinear optimization problems. Along with the traditional BA, its enhanced versions are now also being used to solve optimization problems in science, engineering and medical applications around the globe.

Nature-Inspired Computation in Engineering

The book addresses surrogate-assisted design of antenna arrays, in particular, how surrogate models, both data-driven and physics-based, can be utilized to expedite procedures such as parametric optimization, design closure, statistical analysis, or fault detection. Algorithms and design frameworks are illustrated using a large variety of examples including real-world printed-circuit
This unique compendium contains introductory materials concerning numerical optimization, both conventional (gradient-based and derivative-free, including metaheuristics) and surrogate-based, as well as a considerable selection of customized procedures developed specifically to handle antenna array problems. Recommendations concerning practical aspects of surrogate-assisted multi-objective antenna optimization are also given. The methods presented allow for cost-efficient handling of antenna array design problems (involving CPU-intensive EM models) in the context of design optimization and statistical analysis, which will benefit both researchers, designers and graduate students.

**Big Data Optimization: Recent Developments and Challenges**

The ten-volume set LNCS 12949 – 12958 constitutes the proceedings of the 21st International Conference on Computational Science and Its Applications, ICCSA 2021, which was held in Cagliari, Italy, during September 13 – 16, 2021. The event was organized in a hybrid mode due to the Covid-19 pandemic. The 466 full and 18 short papers presented in these books were carefully reviewed and selected from 1588 submissions. Part VII of the set includes the proceedings of the following workshops: International Workshop on Geomatics for Resource Monitoring and Management (GRMM 2021); International Workshop on Geomatics in Agriculture and Forestry: new advances and perspectives (Geo-for-Agr 2021); 12th International Symposium on Software Quality (SQ 2021); 10th International Workshop on Collective, Massive and Evolutionary Systems (IWCES 2021); International Workshop on Land Use monitoring for Sustainability (LUMS 2021); International Workshop on Machine
Intelligent Computing Methodologies

Researchers and practitioners alike are increasingly turning to search, optimization, and machine-learning procedures based on natural selection and natural genetics to solve problems across the spectrum of human endeavor. These genetic algorithms and techniques of evolutionary computation are solving problems and inventing new hardware and software that rival human designs. The Kluwer Series on Genetic Algorithms and Evolutionary Computation publishes research monographs, edited collections, and graduate-level texts in this rapidly growing field. Primary areas of coverage include the theory, implementation, and application of genetic algorithms (GAs), evolution strategies (ESs), evolutionary programming (EP), learning classifier systems (LCSs) and other variants of genetic and evolutionary computation (GEC). The series also publishes texts in related fields such as artificial life, adaptive behavior, artificial immune systems, agent-based systems, neural computing, fuzzy systems, and quantum computing as long as GEC techniques are part of or inspiration for the system being described. This encyclopedic volume on the use of the algorithms of genetic and evolutionary computation for the solution of multi-objective problems is a landmark addition to the literature that comes just in the nick of time. Multi-objective evolutionary algorithms (MOEAs) are receiving increasing and unprecedented
attention. Researchers and practitioners are finding an irresistible match between the population available in most genetic and evolutionary algorithms and the need in multi-objective problems to approximate the Pareto trade-off curve or surface.

**Artificial Life and Computational Intelligence**

Grid Computing requires the use of software that can divide and farm out pieces of a program to as many as several thousand computers. This book explores processes and techniques needed to create a successful Grid infrastructure. Leading researchers in Europe and the US look at the development of specialist tools and environments which will encourage the convergence of the parallel programming, distributed computing and data management communities. Specific topics covered include: An overview of structural and behavioural properties of Computer Grid applications Discussion of alternative programming techniques Case studies displaying the potential of Computer Grids in solving real problems This book is unique in its outline of the needs of Computational Grids both in integration of high-end resources using OGSA/Globus, and the loose integration of Peer-2-Peer/Entropia/United Devices. Readers will gain an insight on the limitations of existing approaches as well as the standardisation activities currently taking place.

**Simulation-based Optimization Of Antenna Arrays**

Scientific Computing with MATLAB®, Second Edition improves students’ ability to tackle mathematical problems. It helps students understand the mathematical background and find reliable and accurate solutions to
mathematical problems with the use of MATLAB, avoiding the tedious and complex technical details of mathematics. This edition retains the structure of its predecessor while expanding and updating the content of each chapter. The book bridges the gap between problems and solutions through well-grouped topics and clear MATLAB example scripts and reproducible MATLAB-generated plots. Students can effortlessly experiment with the scripts for a deep, hands-on exploration. Each chapter also includes a set of problems to strengthen understanding of the material.

**Soft Computing: Theories and Applications**

The LNCS journal Transactions on Computational Science reflects recent developments in the field of Computational Science, conceiving the field not as a mere ancillary science but rather as an innovative approach supporting many other scientific disciplines. The journal focuses on original high-quality research in the realm of computational science in parallel and distributed environments, encompassing the facilitating theoretical foundations and the applications of large-scale computations and massive data processing. It addresses researchers and practitioners in areas ranging from aerospace to biochemistry, from electronics to geosciences, from mathematics to software architecture, presenting verifiable computational methods, findings, and solutions, and enabling industrial users to apply techniques of leading-edge, large-scale, high performance computational methods. This, the 38th issue of the Transactions on Computational Science, is devoted to research on modelling, optimization, and graphs, with applications in 3D and sketch modelling, engineering design, evolutionary computing, and networks.
Applications of Bat Algorithm and its Variants

This book features research presented at the 1st International Conference on Artificial Intelligence and Applied Mathematics in Engineering, held on 20–22 April 2019 at Antalya, Manavgat (Turkey). In today’s world, various engineering areas are essential components of technological innovations and effective real-world solutions for a better future. In this context, the book focuses on problems in engineering and discusses research using artificial intelligence and applied mathematics. Intended for scientists, experts, M.Sc. and Ph.D. students, postdocs and anyone interested in the subjects covered, the book can also be used as a reference resource for courses related to artificial intelligence and applied mathematics.

Advances in Harmony Search, Soft Computing and Applications

This book presents key advances in intelligent information technologies for industry. This book of Lecture Notes in Networks and Systems contains the papers presented in the main track of IITI 2021, the Fifth International Scientific Conference on Intelligent Information Technologies for Industry held on September 30 – October 4, 2021 in Sirius, Russia. The conference was jointly co-organized by Rostov State Transport University (Russia) and VŠB–Technical University of Ostrava (Czech Republic) with the participation of Russian Association for Artificial Intelligence (RAAI) and Sirius University (Russia). IITI 2021 was devoted to practical models and industrial applications related to intelligent information systems. It was considered as a meeting point for researchers and practitioners to enable the implementation of advanced
information technologies into various industries. Nevertheless, some theoretical talks concerning the state of the art in intelligent systems and soft computing were also included into proceedings. There were 180 paper submissions from 14 countries. Each submission was reviewed by at least three chairs or PC members. We accepted 69 regular papers (38\%). Unfortunately, due to limitations of conference topics and edited volumes, the Program Committee was forced to reject some interesting papers, which did not satisfy these topics or publisher requirements. We would like to thank all authors and reviewers for their work and valuable contributions. The friendly and welcoming attitude of conference supporters and contributors made this event a success!

**Mathematics for Large Scale Computing**

This timely review book summarizes the state-of-the-art developments in nature-inspired optimization algorithms and their applications in engineering. Algorithms and topics include the overview and history of nature-inspired algorithms, discrete firefly algorithm, discrete cuckoo search, plant propagation algorithm, parameter-free bat algorithm, gravitational search, biogeography-based algorithm, differential evolution, particle swarm optimization and others. Applications include vehicle routing, swarming robots, discrete and combinatorial optimization, clustering of wireless sensor networks, cell formation, economic load dispatch, metamodeling, surrogated-assisted cooperative co-evolution, data fitting and reverse engineering as well as other case studies in engineering. This book will be an ideal reference for researchers, lecturers, graduates and engineers who are interested in nature-inspired computation, artificial intelligence and computational intelligence. It can also serve as a reference for relevant courses in computer
science, artificial intelligence and machine learning, natural computation, engineering optimization and data mining.

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