

Veyssel Gazi  
Kevin M. Passino

# Swarm Stability and Optimization

 Springer

# Swarm Stability And Optimization

**William M. Spears, Diana F. Spears**



## **Swarm Stability And Optimization:**

*Swarm Stability and Optimization* Veysel Gazi, Kevin M. Passino, 2011-02-01 Swarming species such as flocks of birds or schools of fish exhibit fascinating collective behaviors during migration and predator avoidance Similarly engineered multi agent dynamic systems such as groups of autonomous ground underwater or air vehicles vehicle swarms exhibit sophisticated collective behaviors while maneuvering In this book we show how to model and control a wide range of such multi agent dynamic systems and analyze their collective behavior using both stability theoretic and simulation based approaches In particular we investigate problems such as group aggregation social foraging formation control swarm tracking distributed agreement and engineering optimization inspired by swarm behavior **Metaheuristic and**

**Evolutionary Computation: Algorithms and Applications** Hasmat Malik, Atif Iqbal, Puneet Joshi, Sanjay Agrawal, Farhad Ilahi Bakhsh, 2020-10-08 This book addresses the principles and applications of metaheuristic approaches in engineering and related fields The first part covers metaheuristics tools and techniques such as ant colony optimization and Tabu search and their applications to several classes of optimization problems In turn the book s second part focuses on a wide variety of metaheuristics applications in engineering and or the applied sciences e g in smart grids and renewable energy In addition the simulation codes for the problems discussed are included in an appendix for ready reference Intended for researchers aspiring to learn and apply metaheuristic techniques and gathering contributions by prominent experts in the field the book offers readers an essential introduction to metaheuristics its theoretical aspects and applications **Particle Swarm**

**Optimization Stability Analysis** Ouboti Seydou Eyanaa Djaneye-Boundjou, OhioLINK Electronic Theses and Dissertations Center, 2013 Optimizing a multidimensional function uni modal or multi modal is a problem that regularly comes about in engineering and science Evolutionary Computation techniques including Evolutionary Algorithm and Swarm Intelligence SI are biological systems inspired search methods often used to solve optimization problems In this thesis the SI technique Particle Swarm Optimization PSO is studied Convergence and stability of swarm optimizers have been subject of PSO research Here using discrete time adaptive control tools found in literature an adaptive particle swarm optimizer is developed An error system is devised and a controller is designed to adaptively drive the error to zero The controller features a function approximator used here as a predictor to estimate future signals Through Lyapunov s direct method it is shown that the devised error system is ultimately uniformly bounded and the adaptive optimizer is stable Moreover through LaSalle Yoshizawa theorem it is also shown that the error system goes to zero as time evolves Experiments are performed on a variety of benchmark functions and results for comparison purposes between the adaptive optimizer and other algorithms found in literature are provided *Computational Intelligence* Rudolf Kruse, Christian Borgelt, Christian Braune, Sanaz Mostaghim, Matthias Steinbrecher, 2016-09-16 This textbook provides a clear and logical introduction to the field covering the fundamental concepts algorithms and practical implementations behind efforts to develop systems that exhibit intelligent

behavior in complex environments This enhanced second edition has been fully revised and expanded with new content on swarm intelligence deep learning fuzzy data analysis and discrete decision graphs Features provides supplementary material at an associated website contains numerous classroom tested examples and definitions throughout the text presents useful insights into all that is necessary for the successful application of computational intelligence methods explains the theoretical background underpinning proposed solutions to common problems discusses in great detail the classical areas of artificial neural networks fuzzy systems and evolutionary algorithms reviews the latest developments in the field covering such topics as ant colony optimization and probabilistic graphical models      Railway Engineering Technology V. M. Ravindra Kumar,K. P. Vineesh,Sunil Kumar Sharma,2025-09-30 This book presents advances in railway engineering including railway wheels wheel failure mechanisms innovations in railway track designs and axle failures It covers rail wheel traction characteristics under various environmental conditions for full scale test conditions including braking systems It provides an understanding of the applications of digital twin technology in railway systems predictive maintenance performance optimization and overall system efficiency It also emphasizes sustainable practices energy efficient technologies and environmental impact assessments Features Comprehensively reviews various aspects of railway engineering technology Discusses major failure mechanisms and various types of braking systems Covers the modernization of railways and high speed trains Explores emerging topics such as digital twin technology sustainable practices and autonomous technologies Includes case studies of railway component failures and accidents This book is aimed at researchers and professionals in railway and mechanical engineering as well as transportation systems      *Physicomimetics* William M. Spears,Diana F. Spears,2012-01-05 Standard approaches to understanding swarms rely on inspiration from biology and are generally covered by the term biomimetics This book focuses on a different complementary inspiration namely physics The editors have introduced the term physicomimetics to refer to physics based swarm approaches which offer two advantages First they capture the notion that nature is lazy meaning that physics based systems always perform the minimal amount of work necessary which is an especially important advantage in swarm robotics Second physics is the most predictive science and can reduce complex systems to simple concepts and equations that codify emergent behavior and help us to design and understand swarms The editors consolidated over a decade of work on swarm intelligence and swarm robotics organizing the book into 19 chapters as follows Part I introduces the concept of swarms and offers the reader a physics tutorial Part II deals with applications of physicomimetics in order of increased complexity Part III examines the hardware requirements of the presented algorithms and demonstrates real robot implementations Part IV demonstrates how the theory can be used to design swarms from first principles and provides a novel algorithm that handles changing environments finally Part V shows that physicomimetics can be used for function optimization moving the reader from issues of swarm robotics to swarm intelligence The text is supported with a downloadable package containing simulation code and videos of working robots This book is suitable for

talented high school and undergraduate students as well as researchers and graduate students in the areas of artificial intelligence and robotics      **Applications of Flower Pollination Algorithm and its Variants** Nilanjan Dey,2021-03-17

This book presents essential concepts of traditional Flower Pollination Algorithm FPA and its recent variants and also its application to find optimal solution for a variety of real world engineering and medical problems Swarm intelligence based meta heuristic algorithms are extensively implemented to solve a variety of real world optimization problems due to its adaptability and robustness FPA is one of the most successful swarm intelligence procedures developed in 2012 and extensively used in various optimization tasks for more than a decade The mathematical model of FPA is quite straightforward and easy to understand and enhance compared to other swarm approaches Hence FPA has attracted attention of researchers who are working to find the optimal solutions in variety of domains such as N dimensional numerical optimization constrained unconstrained optimization and linear nonlinear optimization problems Along with the traditional bat algorithm the enhanced versions of FPA are also considered to solve a variety of optimization problems in science engineering and medical applications      **Advances in Metaheuristics** Timothy Ganesan,Pandian Vasant,Irraivan

Elamvazuthi,2016-11-28 Advances in Metaheuristics Applications in Engineering Systems provides details on current approaches utilized in engineering optimization It gives a comprehensive background on metaheuristic applications focusing on main engineering sectors such as energy process and materials It discusses topics such as algorithmic enhancements and performance measurement approaches and provides insights into the implementation of metaheuristic strategies to multi objective optimization problems With this book readers can learn to solve real world engineering optimization problems effectively using the appropriate techniques from emerging fields including evolutionary and swarm intelligence mathematical programming and multi objective optimization The ten chapters of this book are divided into three parts The first part discusses three industrial applications in the energy sector The second focusses on process optimization and considers three engineering applications optimization of a three phase separator process plant and a pre treatment process The third and final part of this book covers industrial applications in material engineering with a particular focus on sand mould systems It also includes discussions on the potential improvement of algorithmic characteristics via strategic algorithmic enhancements This book helps fill the existing gap in literature on the implementation of metaheuristics in engineering applications and real world engineering systems It will be an important resource for engineers and decision makers selecting and implementing metaheuristics to solve specific engineering problems      **Particle Swarm**

**Optimisation** Jun Sun,2016-04-19 Although the particle swarm optimisation PSO algorithm requires relatively few parameters and is computationally simple and easy to implement it is not a globally convergent algorithm In Particle Swarm Optimisation Classical and Quantum Perspectives the authors introduce their concept of quantum behaved particles inspired by quantum mechanics which leads to the quantum behaved particle swarm optimisation QPSO algorithm This globally

convergent algorithm has fewer parameters a faster convergence rate and stronger searchability for complex problems The book presents the concepts of optimisation problems as well as random search methods for optimisation before discussing the principles of the PSO algorithm Examples illustrate how the PSO algorithm solves optimisation problems The authors also analyse the reasons behind the shortcomings of the PSO algorithm Moving on to the QPSO algorithm the authors give a thorough overview of the literature on QPSO describe the fundamental model for the QPSO algorithm and explore applications of the algorithm to solve typical optimisation problems They also discuss some advanced theoretical topics including the behaviour of individual particles global convergence computational complexity convergence rate and parameter selection The text closes with coverage of several real world applications including inverse problems optimal design of digital filters economic dispatch problems biological multiple sequence alignment and image processing MATLAB Fortran and C source codes for the main algorithms are provided on an accompanying downloadable resources Helping you numerically solve optimisation problems this book focuses on the fundamental principles and applications of PSO and QPSO algorithms It not only explains how to use the algorithms but also covers advanced topics that establish the groundwork for understanding

*Application of Big Data, Blockchain, and Internet of Things for Education Informatization* Yinjun Zhang, Nazir Shah, 2024-06-30 The five volume set LNICST 580 584 constitutes the proceedings of the Third EAI International Conference on Application of Big Data Blockchain and Internet of Things for Education Informatization BigIoT EDU 2023 held in Liuzhou China during August 29 31 2023 The 272 full papers presented in these proceedings were carefully reviewed and selected from 718 submissions With a primary focus on research fields such as Digitization of education Smart classrooms and Massive Online Open Courses MOOCs these papers are organized in the following topical sections across the five volumes Part I Application of data mining in smart education Application of intelligent algorithms in English teaching Part II Application of decision tree algorithm in intelligent management system of universities Research on the application of Big data in smart teaching Part III Exploration of the application of computer aided technology in intelligent translation Application of neural network algorithms in intelligent teaching Application of artificial intelligence algorithms in the field of smart education Part IV Research on smart teaching in deep learning Research and application of recommendation algorithms in personalized intelligent education Application of cloud computing in intelligent teaching resource library Application research of computer aided online intelligent teaching Part V Application and practice of new media in smart teaching Application of clustering algorithm in intelligent education resource library Application of association rule algorithm in intelligent education system

**Emerging Technologies for the Construction of Renewable Energy-Dominated Power System** Liansong Xiong, Haitao Zhang, Sergio Amedeo Pignari, Yushuai Li, Anant Kumar Verma, Yonghui Liu, Jin Ye, Chaoran Zhuo, 2024-12-02 Over the past decade significant breakthroughs have been achieved in renewable energy generation operation and control technology greatly enhancing the safe operation and efficient utilization of renewable

energy However as the penetration ratio of the renewable energy continues to grow the characteristics of randomness variability weak inertia and damping have posed great challenges to the power generation operation and control There is an urgent need to provide efficient safe and diverse technological choices for the construction of the renewable energy dominated power system 1 Improving the efficiency of renewable energy generation and transmission 2 Increasing the capability of renewable energy to support and regulate the system voltage frequency and inertia thus guaranteeing the security and stability operation of power systems 3 Scaling up development of offshore wind power and distributed renewable energy in remote regions like Gobi Desert requires technological innovation for further development

**Applications of Evolutionary Computation** Paul Kaufmann, Pedro A. Castillo, 2019-04-10 This book constitutes the refereed proceedings of the 22nd International Conference on Applications of Evolutionary Computation EvoApplications 2019 held in Leipzig Germany in April 2019 co located with the Evo 2019 events EuroGP EvoCOP and EvoMUSART The 44 revised full papers presented were carefully reviewed and selected from 66 submissions They were organized in topical sections named Engineering and Real World Applications Games General Image and Signal Processing Life Sciences Networks and Distributed Systems Neuroevolution and Data Analytics Numerical Optimization Theory Benchmarks and Applications Robotics *Spatial Modelling and Failure Analysis of Natural and Engineering Disasters through Data-based Methods - Volume II* Faming Huang, Zizheng Guo, Huokun Li, Hai Lin, 2023-08-01 [Handbook of Metaheuristics](#) Michel Gendreau, Jean-Yves Potvin, 2018-09-20 The third edition of this handbook is designed to provide a broad coverage of the concepts implementations and applications in metaheuristics The book s chapters serve as stand alone presentations giving both the necessary underpinnings as well as practical guides for implementation The nature of metaheuristics invites an analyst to modify basic methods in response to problem characteristics past experiences and personal preferences and the chapters in this handbook are designed to facilitate this process as well This new edition has been fully revised and features new chapters on swarm intelligence and automated design of metaheuristics from flexible algorithm frameworks The authors who have contributed to this volume represent leading figures from the metaheuristic community and are responsible for pioneering contributions to the fields they write about Their collective work has significantly enriched the field of optimization in general and combinatorial optimization in particular Metaheuristics are solution methods that orchestrate an interaction between local improvement procedures and higher level strategies to create a process capable of escaping from local optima and performing a robust search of a solution space In addition many new and exciting developments and extensions have been observed in the last few years Hybrids of metaheuristics with other optimization techniques like branch and bound mathematical programming or constraint programming are also increasingly popular On the front of applications metaheuristics are now used to find high quality solutions to an ever growing number of complex ill defined real world problems in particular combinatorial ones This handbook should continue to be a great reference for researchers graduate

students as well as practitioners interested in metaheuristics      *Issues in Logic, Probability, Combinatorics, and Chaos Theory: 2013 Edition* ,2013-05-01 Issues in Logic Probability Combinatorics and Chaos Theory 2013 Edition is a ScholarlyEditions book that delivers timely authoritative and comprehensive information about Approximation Theory The editors have built Issues in Logic Probability Combinatorics and Chaos Theory 2013 Edition on the vast information databases of ScholarlyNews You can expect the information about Approximation Theory in this book to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of Issues in Logic Probability Combinatorics and Chaos Theory 2013 Edition has been produced by the world s leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions and available exclusively from us You now have a source you can cite with authority confidence and credibility More information is available at <http://www.ScholarlyEditions.com>

**Automotive, Mechanical and Electrical Engineering** Lin Liu,2017-06-26 The 2016 International Conference on Automotive Engineering Mechanical and Electrical Engineering AEMEE 2016 was held December 9 11 2016 in Hong Kong China AEMEE 2016 was a platform for presenting excellent results and new challenges facing the fields of automotive mechanical and electrical engineering Automotive Mechanical and Electrical Engineering brings together a wide range of contributions from industry and governmental experts and academics experienced in engineering design and research Papers have been categorized under the following headings Automotive Engineering and Rail Transit Engineering Mechanical Manufacturing Process Engineering Network Communications and Applied Information Technologies Technologies in Energy and Power Cell Engines Generators Electric Vehicles System Test and Diagnosis Monitoring and Identification Video and Image Processing Applied and Computational Mathematics Methods Algorithms and Optimization Technologies in Electrical and Electronic Control and Automation Industrial Production Manufacturing Management and Logistics      **Electricity Pricing** Sawan Sen,Samarjit Sengupta,Abhijit Chakrabarti,2018-09-03 Electricity Pricing Regulated Deregulated and Smart Grid Systems presents proven methods for supplying uninterrupted high quality electrical power at a reasonable price to the consumer Illustrating the evolution of the power market from a monopoly to an open access system this essential text Covers voltage stability analysis of longitudinal power supply systems using an artificial neural network ANN Explains how to improve performance using flexible alternating current transmission systems FACTS and high voltage direct current HVDC Takes into account operating constraints as well as generation cost line overload and congestion for expected and inadvertent loading stress Goes beyond FACTS and HVDC to provide multi objective optimization algorithms for the deregulated power market Proposes the use of stochastic optimization techniques in the smart grid preparing the reader for future development Electricity Pricing Regulated Deregulated and Smart Grid Systems offers practical solutions for improving stability reliability and efficiency in real time systems while optimizing electricity cost      *19th European*



*Symposium on Computer Aided Process Engineering* Jacek Jezowski, Jan Thullie, 2009-06-12 The 19th European Symposium on Computer Aided Process Engineering contains papers presented at the 19th European Symposium of Computer Aided Process Engineering ESCAPE 19 held in Cracow Poland June 14 17 2009 The ESCAPE series serves as a forum for scientists and engineers from academia and industry to discuss progress achieved in the area of CAPE 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 CAPE     *Advancements in Smart Computing and Information Security* Sridaran Rajagopal, Kalpesh Popat, Divyakant Meva, Sunil Bajaja, 2024-05-01 This 4 volume CCIS post conference set represents the proceedings of the Second International Conference on Advances in Smart Computing and Information Security ASCIS 2023 in Rajkot Gujarat India December 2023 The 91 full papers and 36 short papers in the volume were carefully checked and selected from 432 submissions Various application areas were presented at the conference including healthcare agriculture automotive construction and engineering pharmaceuticals cybercrime and sports     Green Energy, Environment and Sustainable Development Chongqing Wang, Xiaoshuan Zhang, Hongyu Ren, Yingfa Lu, 2023-10-15 The subjects of green energy and sustainability have never been more important as governments around the world wrestle with the problem of how to protect the planet from the damage being caused to the environment by climate change This book presents the proceedings of GEESD2023 the 4th International Conference on Green Energy Environment and Sustainable Development held in Mianyang China from 15 17 June 2023 and online via Zoom The conference aims to gather innovative academicians and industry experts in the fields of green energy environment and sustainable development in a common forum providing a platform for the exchange of the latest research developments in related fields This year the call for papers attracted more than 280 submissions 138 of which were accepted for inclusion in this collection The process of evaluation and peer review took place over six months and involved more than 100 TPC members and reviewers The book is divided into 7 sections green energy and systems computer methods in the environment chemistry and the environment ecology and the rural environment energy environment and economy environment and pollution and water and mineral resources Papers deal with the most up to date findings and technologies The book provides a valuable overview of the latest research and developments and will be of interest to all those working in the fields of green energy and sustainable development

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