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MODERN HEURISTIC OPTIMIZATION TECHNIQUES

THEORY AND APPLICATIONS TO POWER SYSTEMS

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Modern Heuristic Optimization Techniques With Applications To Power Systems

Alfredo Vaccaro



Modern Heuristic Optimization Techniques With Applications To Power Systems:

Modern Heuristic Optimization Techniques Kwang Y. Lee, Mohamed A. El-Sharkawi, 2008-02-08 This book explores how developing solutions with heuristic tools offers two major advantages shortened development time and more robust systems It begins with an overview of modern heuristic techniques and goes on to cover specific applications of heuristic approaches to power system problems such as security assessment optimal power flow power system scheduling and operational planning power generation expansion planning reactive power planning transmission and distribution planning network reconfiguration power system control and hybrid systems of heuristic methods

Modern Heuristic Optimization Techniques Kwang Y. Lee, Mohamed A. El-Sharkawi, 2008-02-13 This book explores how developing solutions with heuristic tools offers two major advantages shortened development time and more robust systems It begins with an overview of modern heuristic techniques and goes on to cover specific applications of heuristic approaches to power system problems such as security assessment optimal power flow power system scheduling and operational planning power generation expansion planning reactive power planning transmission and distribution planning network reconfiguration power system control and hybrid systems of heuristic methods

Modern Optimization Techniques with Applications in Electric Power Systems Soliman Abdel-Hady Soliman, Abdel-Aal Hassan Mantawy, 2011-12-14 This book presents the application of some AI related optimization techniques in the operation and control of electric power systems With practical applications and examples the use of functional analysis simulated annealing Tabu search Genetic algorithms and fuzzy systems for the optimization of power systems is discussed in detail Preliminary mathematical concepts are presented before moving to more advanced material Researchers and graduate students will benefit from this book Engineers working in utility companies operations and control and resource management will also find this book useful

Applications of Modern Heuristic Optimization Methods in Power and Energy Systems Kwang Y. Lee, Zita A. Vale, 2020-04-14 Reviews state of the art technologies in modern heuristic optimization techniques and presents case studies showing how they have been applied in complex power and energy systems problems Written by a team of international experts this book describes the use of metaheuristic applications in the analysis and design of electric power systems This includes a discussion of optimum energy and commitment of generation nonrenewable renewable and load resources during day to day operations and control activities in regulated and competitive market structures along with transmission and distribution systems Applications of Modern Heuristic Optimization Methods in Power and Energy Systems begins with an introduction and overview of applications in power and energy systems before moving on to planning and operation control and distribution Further chapters cover the integration of renewable energy and the smart grid and electricity markets The book finishes with final conclusions drawn by the editors Applications of Modern Heuristic Optimization Methods in Power and Energy Systems Explains the application of differential evolution in electric power systems active power multi objective optimal dispatch

Includes studies of optimization and stability in load frequency control in modern power systems Describes optimal compliance of reactive power requirements in near shore wind power plants Features contributions from noted experts in the field Ideal for power and energy systems designers planners operators and consultants Applications of Modern Heuristic Optimization Methods in Power and Energy Systems will also benefit engineers software developers researchers academics and students Tutorial on Modern Heuristic Optimization Techniques with Applications to Power Systems Kwang Young Lee, Mohamed A. El-Sharkawi, 2002* **Probabilistic Power System Expansion Planning with Renewable Energy Resources and Energy Storage Systems** Jaeseok Choi, Kwang Y. Lee, 2021-10-12 Probabilistic Power System Expansion Planning with Renewable Energy Resources and Energy Storage Systems Discover how modern techniques have shaped complex power system expansion planning with this one stop resource from two experts in the field Probabilistic Power System Expansion Planning with Renewable Energy Resources and Energy Storage Systems delivers a comprehensive collection of innovative approaches to the probabilistic planning of generation and transmission systems under uncertainties The book includes renewables and energy storage calculations when using probabilistic and deterministic reliability techniques to assess system performance from a long term expansion planning viewpoint Divided into two sections the book first covers topics related to Generation Expansion Planning with chapters on cost assessment methodology and optimization and more The second and final section provides information on Transmission System Expansion Planning with chapters on reliability constraints probabilistic production cost simulation and more Probabilistic Power System Expansion Planning compares the optimization and methodology across dynamic linear and integer programming and explores the branch and bound algorithm Along with case studies to demonstrate how the techniques described within have been applied in complex power system expansion planning problems readers will enjoy A thorough discussion of generation expansion planning including cost assessment methodology and optimization and probabilistic production cost An exploration of transmission system expansion planning including the branch and bound algorithm probabilistic production cost simulation for TEP and TEP with reliability constraints An examination of fuzzy decision making applied to transmission system expansion planning A treatment of probabilistic reliability based grid expansion planning of power systems including wind turbine generators Perfect for power and energy systems designers planners operators consultants practicing engineers software developers and researchers Probabilistic Power System Expansion Planning with Renewable Energy Resources and Energy Storage Systems will also earn a place in the libraries of practicing engineers who regularly deal with optimization problems

Modern Optimisation Techniques in Power Systems Yong-Hua Song, 2013-03-14 The electric power industry is currently undergoing an unprecedented reform The deregulation of electricity supply industry has introduced new opportunity for competition to reduce the cost and cut the price It is a tremendous challenge for utilities to maintain an economical and reliable supply of electricity in such an environment Faced by an increasingly complicated existence power utilities need

efficient tools and aids to ensure that electrical energy of the desired quality can be provided at the lowest cost The overall objective both for short term and long term operations is then to find the best compromise between the requirements of security and economy That is effective tools are urgently required to solve highly constrained optimisation problems In recent years several major modern optimisation techniques have been applied to power systems A large number of papers and reports have been published In this respect it is timely to edit a book on this topic with an aim to report the state of the art development internationally in this area

Advanced Solutions in Power Systems Mircea Eremia,Chen-Ching Liu,Abdel-Aty Edris,2016-10-03 Provides insight on both classical means and new trends in the application of power electronic and artificial intelligence techniques in power system operation and control This book presents advanced solutions for power system controllability improvement transmission capability enhancement and operation planning The book is organized into three parts The first part describes the CSC HVDC and VSC HVDC technologies the second part presents the FACTS devices and the third part refers to the artificial intelligence techniques All technologies and tools approached in this book are essential for power system development to comply with the smart grid requirements Discusses detailed operating principles and diagrams theory of modeling control strategies and physical installations around the world of HVDC and FACTS systems Covers a wide range of Artificial Intelligence techniques that are successfully applied for many power system problems from planning and monitoring to operation and control Each chapter is carefully edited with drawings and illustrations that helps the reader to easily understand the principles of operation or application **Advanced Solutions in Power Systems** HVDC FACTS and Artificial Intelligence is written for graduate students researchers in transmission and distribution networks and power system operation This book also serves as a reference for professional software developers and practicing engineers

Power Plants and Power Systems Control 2006 David Westwick,2007-02-06 Control plays a very important role in all aspects of power plants and power systems The papers included in the 2006 Proceedings are by authors from a large number of countries around the world They encompass a wide spectrum of topics in the control of practically every aspect of power plants and power systems

Decision Making Applications in Modern Power Systems Shady Abdel Aleem,Almoataz Youssef Abdelaziz,Ahmed F. Zobaa,Ramesh C. Bansal,2019-09-21 Decision Making Applications in Modern Power Systems presents an enhanced decision making framework for power systems Designed as an introduction to enhanced electricity system analysis using decision making tools it provides an overview of the different elements levels and actors involved within an integrated framework for decision making in the power sector In addition it presents a state of play on current energy systems strategies alternatives viewpoints and priorities in support of decision making in the electric power sector including discussions of energy storage and smart grids As a practical training guide on theoretical developments and the application of advanced methods for practical electrical energy engineering problems this reference is ideal for use in establishing medium term and long term strategic plans for the electric power and energy

sectors Provides panoramic coverage of state of the art energy systems strategies and priorities in support of electrical power decision making Introduces innovative research outcomes programs algorithms and approaches to address challenges in understanding creating and managing complex techno socio economic engineering systems Includes practical training on theoretical developments and the application of advanced methods for realistic electrical energy engineering problems

The 15th International Conference Interdisciplinarity in Engineering Liviu Moldovan, Adrian Gligor, 2022-02-02

This book contains research papers that were accepted for presentation at the 15th International Conference on Interdisciplinarity in Engineering INTER ENG 2021 which was held on October 7 8 2021 in the city of Trgu Mure Romania The general scope of the conference Innovative aspects of Industry 4 0 concepts aimed at consolidating the digital future of manufacturing in companies is proposing a new approach related to the development of a new generation of smart factories grounded on the manufacturing and assembly process digitalization It is related to advance manufacturing technology lean manufacturing sustainable manufacturing additive manufacturing and manufacturing tools and equipment It is a leading international professional and scientific forum of great interest for engineers and scientists who can read in this book research works contributions and recent developments as well as current practices in advanced fields of engineering

Modelling, Simulation and Control of Thermal Energy Systems Kwang Y. Lee, Damian Flynn, Hui Xie, Li Sun, 2020-11-03

Faced with an ever growing resource scarcity and environmental regulations the last 30 years have witnessed the rapid development of various renewable power sources such as wind tidal and solar power generation The variable and uncertain nature of these resources is well known while the utilization of power electronic converters presents new challenges for the stability of the power grid Consequently various control and operational strategies have been proposed and implemented by the industry and research community with a growing requirement for flexibility and load regulation placed on conventional thermal power generation Against this background the modelling and control of conventional thermal engines such as those based on diesel and gasoline are experiencing serious obstacles when facing increasing environmental concerns Efficient control that can fulfill the requirements of high efficiency low pollution and long durability is an emerging requirement The modelling simulation and control of thermal energy systems are key to providing innovative and effective solutions Through applying detailed dynamic modelling a thorough understanding of the thermal conversion mechanisms can be achieved based on which advanced control strategies can be designed to improve the performance of the thermal energy system both in economic and environmental terms Simulation studies and test beds are also of great significance for these research activities prior to proceeding to field tests This Special Issue will contribute a practical and comprehensive forum for exchanging novel research ideas or empirical practices that bridge the modelling simulation and control of thermal energy systems Papers that analyze particular aspects of thermal energy systems involving for example conventional power plants innovative thermal power generation various thermal engines thermal energy storage and fundamental heat transfer

management on the basis of one or more of the following topics are invited in this Special Issue Power plant modelling simulation and control Thermal engines Thermal energy control in building energy systems Combined heat and power CHP generation Thermal energy storage systems Improving thermal comfort technologies Optimization of complex thermal systems Modelling and control of thermal networks Thermal management of fuel cell systems Thermal control of solar utilization Heat pump control Heat exchanger control

Handbook of Research on Modern Optimization Algorithms and Applications in Engineering and Economics Vasant, Pandian, Weber, Gerhard-Wilhelm, Dieu, Vo Ngoc, 2016-03-08

Modern optimization approaches have attracted many research scientists decision makers and practicing researchers in recent years as powerful intelligent computational techniques for solving several complex real world problems The Handbook of Research on Modern Optimization Algorithms and Applications in Engineering and Economics highlights the latest research innovations and applications of algorithms designed for optimization applications within the fields of engineering IT and economics Focusing on a variety of methods and systems as well as practical examples this book is a significant resource for graduate level students decision makers and researchers in both public and private sectors who are seeking research based methods for modeling uncertain real world problems

Interval Methods for Uncertain Power System Analysis Alfredo Vaccaro, 2023-07-12 Interval Methods for Uncertain Power System Analysis In Interval Methods for Uncertain Power System Analysis accomplished engineer Dr Alfredo Vaccaro delivers a comprehensive discussion of the mathematical foundations of range analysis and its application to solving traditional power system operation problems in the presence of strong and correlated uncertainties The book explores highly relevant topics in the area from interval methods for uncertainty representation and management to a variety of application examples The author offers readers the latest methodological breakthroughs and roadmaps to implementing the mathematics discussed within as well as best practices commonly employed across the industry Interval Methods for Uncertain Power System Analysis includes examinations of linear and non linear equations as well as A thorough introduction to reliable computing including discussions of interval arithmetic and interval based operators Comprehensive explorations of uncertain power flow analysis including discussions of problem formulation and sources of uncertainty in power flow analysis In depth examinations of uncertain optimal power flow analysis Fulsome discussions of uncertain small signal stability analysis including treatments of how to compute eigenvalues of uncertain matrices Perfect for engineers working in power flow and optimal power flow analyses optimization theory and computer aided simulation Interval Methods for Uncertain Power System Analysis will also earn a place in the libraries of researchers and graduate students studying decision making under uncertainty in power systems operation

Genetic Optimization Techniques for Sizing and Management of Modern Power Systems Juan Miguel Lujano Rojas, Rodolfo Dufo Lopez, Jose Antonio Dominguez Navarro, 2022-09-28 Genetic Optimization Techniques for Sizing and Management of Modern Power Systems explores the design and management of energy systems using a genetic algorithm as

the primary optimization technique Coverage ranges across topics related to resource estimation and energy systems simulation Chapters address the integration of distributed generation the management of electric vehicle charging and microgrid dimensioning for resilience enhancement with detailed discussion and solutions using parallel genetic algorithms The work is suitable for researchers and practitioners working in power systems optimization requiring information for systems planning purposes seeking knowledge on mathematical models available for simulation and assessment and relevant applications in energy policy Presents a range of essential techniques for using genetic algorithms in power system analysis including economic dispatch forecasting and optimal power flow among other topics Addresses relevant optimization problems such as neural network training and clustering analysis using genetic algorithms Discusses clearly and straightforwardly the implementation of genetic algorithms and its combination with other heuristic techniques Describes the iHOGA and MHOGA commercial tools which utilize genetic algorithms for designing and managing energy systems based on renewable energies

PowerFactory Applications for Power System Analysis Francisco M. Gonzalez-Longatt, José Luis Rueda, 2014-12-27 This book presents a comprehensive set of guidelines and applications of DIgSILENT PowerFactory an advanced power system simulation software package for different types of power systems studies Written by specialists in the field it combines expertise and years of experience in the use of DIgSILENT PowerFactory with a deep understanding of power systems analysis These complementary approaches therefore provide a fresh perspective on how to model simulate and analyse power systems It presents methodological approaches for modelling of system components including both classical and non conventional devices used in generation transmission and distribution systems discussing relevant assumptions and implications on performance assessment This background is complemented with several guidelines for advanced use of DSL and DPL languages as well as for interfacing with other software packages which is of great value for creating and performing different types of steady state and dynamic performance simulation analysis All employed test case studies are provided as supporting material to the reader to ease recreation of all examples presented in the book as well as to facilitate their use in other cases related to planning and operation studies Providing an invaluable resource for the formal instruction of power system undergraduate postgraduate students this book is also a useful reference for engineers working in power system operation and planning

Adaptive Stochastic Optimization Techniques with Applications James A. Momoh, 2015-12-02 Adaptive Stochastic Optimization Techniques with Applications provides a single convenient source for state of the art information on optimization techniques used to solve problems with adaptive dynamic and stochastic features Presenting modern advances in static and dynamic optimization decision analysis intelligent systems evolutionary pro

Wind Power Systems Lingfeng Wang, Chanan Singh, Andrew Kusiak, 2010-09-15 Renewable energy sources such as wind power have attracted much attention because they are environmentally friendly do not produce carbon dioxide and other emitants and can enhance a nation s energy security For example recently more significant amounts of wind power are being

integrated into conventional power grids Therefore it is necessary to address various important and challenging issues related to wind power systems which are significantly different from the traditional generation systems This book is a resource for engineers practitioners and decision makers interested in studying or using the power of computational intelligence based algorithms in handling various important problems in wind power systems at the levels of power generation transmission and distribution Researchers have been developing biologically inspired algorithms in a wide variety of complex large scale engineering domains Distinguished from the traditional analytical methods the new methods usually accomplish the task through their computationally efficient mechanisms Computational intelligence methods such as evolutionary computation neural networks and fuzzy systems have attracted much attention in electric power systems Meanwhile modern electric power systems are becoming more and more complex in order to meet the growing electricity market In particular the grid complexity is continuously enhanced by the integration of intermittent wind power as well as the current restructuring efforts in electricity industry Quite often the traditional analytical methods become less efficient or even unable to handle this increased complexity As a result it is natural to apply computational intelligence as a powerful tool to deal with various important and pressing problems in the current wind power systems This book presents the state of the art development in the field of computational intelligence applied to wind power systems by reviewing the most up to date work and representative practical problems collecting contributions from leading experts in electrical engineering system engineering and other disciplines

Power Flow Control Solutions for a Modern Grid Using SMART Power Flow Controllers Kalyan K. Sen, Mey Ling Sen, 2021-12-29 Power Flow Control Solutions for a Modern Grid using SMART Power Flow Controllers Provides students and practicing engineers with the foundation required to perform studies of power system networks and mitigate unique power flow problems Power Flow Control Solutions for a Modern Grid using SMART Power Flow Controllers is a clear and accessible introduction to power flow control in complex transmission systems Starting with basic electrical engineering concepts and theory the authors provide step by step explanations of the modeling techniques of various power flow controllers PFCs such as the voltage regulating transformer VRT the phase angle regulator PAR and the unified power flow controller UPFC The textbook covers the most up to date advancements in the transformer ST including various forms of two core designs and hybrid architectures for a wide variety of applications Beginning with an overview of the origin and development of modern power flow controllers the authors explain each topic in straightforward engineering terms corroborating theory with relevant mathematics Throughout the text easy to understand chapters present characteristic equations of various power flow controllers explain modeling in the Electromagnetic Transients Program EMTP compare transformer based and mechanically switched PFCs discuss grid congestion and power flow limitations and more This comprehensive textbook Describes why effective Power Flow Controllers should be viewed as impedance regulators Provides computer simulation codes of the various power flow controllers in the EMTP programming

language Contains numerous worked examples and data cases to clarify complex issues Includes results from the simulation study of an actual network Features models based on the real world experiences the authors co inventors of first generation FACTS controllers Written by two acknowledged leaders in the field Power Flow Control Solutions for a Modern Grid using SMART Power Flow Controllers is an ideal textbook for graduate students in electrical engineering and a must read for power engineering practitioners regulators and researchers

Microgrids Nikos Hatziaargyriou, 2014-03-03 Microgrids are the most innovative area in the electric power industry today Future microgrids could exist as energy balanced cells within existing power distribution grids or stand alone power networks within small communities A definitive presentation on all aspects of microgrids this text examines the operation of microgrids their control concepts and advanced architectures including multi microgrids It takes a logical approach to overview the purpose and the technical aspects of microgrids discussing the social economic and environmental benefits to power system operation The book also presents microgrid design and control issues including protection and explaining how to implement centralized and decentralized control strategies Key features original state of the art research material written by internationally respected contributors unique case studies demonstrating success stories from real world pilot sites from Europe the Americas Japan and China examines market and regulatory settings for microgrids and provides evaluation results under standard test conditions a look to the future technical solutions to maximize the value of distributed energy along with the principles and criteria for developing commercial and regulatory frameworks for microgrids Offering broad yet balanced coverage this volume is an entry point to this very topical area of power delivery for electric power engineers familiar with medium and low voltage distribution systems utility operators in microgrids power systems researchers and academics It is also a useful reference for system planners and operators manufacturers and network operators government regulators and postgraduate power systems students

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