

MODERN OPTIMIZATION TECHNIQUES IN POWER SYSTEMS

OBJECTIVES

1. To have knowledge on optimization techniques applied to power systems.
2. To understand the different evolutionary computation techniques and multi objective optimization and their applications in power systems.

UNIT I - FUNDAMENTALS OF OPTIMIZATION

Definition-Classification of optimization problems-Unconstrained and Constrained optimization-Optimality conditions-Classical Optimization techniques (Linear and nonlinear programming, Quadratic programming, Mixed integer programming)-Intelligent Search methods (Optimization neural network, Evolutionary algorithms, Tabu search, Particle swarm optimization, Application of fuzzy set theory).

UNIT II - EVOLUTIONARY COMPUTATION TECHNIQUES

Evolution in nature-Fundamentals of Evolutionary algorithms-Working Principles of Genetic Algorithm- Evolutionary Strategy and Evolutionary Programming-Genetic Operators-Selection, Crossover and Mutation-Issues in GA implementation- GA based Economic Dispatch solution-Fuzzy Economic Dispatch including losses- Tabu search algorithm for unit commitment problem-GA for unit commitment-GA based Optimal power flow- GA based state estimation.

UNIT III - PARTICLE SWARM OPTIMIZATION

Fundamental principle-Velocity Updating-Advanced operators-Parameter selection-Hybrid approaches (Hybrid of GA and PSO, Hybrid of EP and PSO) -Binary, discrete and combinatorial PSO-Implementation issues Convergence issues- PSO based OPF problem and unit commitment-PSO for reactive power and voltage control-PSO for power system reliability and security.

UNIT IV - ADVANCED OPTIMIZATION METHODS

Simulated annealing algorithm-Tabu search algorithm-SA and TS for unit commitment-Ant colony optimization- Bacteria Foraging optimization.

UNIT V - MULTI OBJECTIVE OPTIMIZATION

Concept of pareto optimality-Conventional approaches for MOOP-Multi objective GA-Fitness assignment-Sharing function-Economic Emission dispatch using MOGA-Multi objective PSO (Dynamic neighborhood PSO, Vector evaluated PSO) -Multi objective OPF problem.

REFERENCES

Modern Optimization Techniques In Power Systems

Kwang Y. Lee, Mohamed A. El-Sharkawi



Modern Optimization Techniques In Power Systems:

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

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

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 for Smart Grids Adel Ali Abou El-Ela, Mohamed T. Mouwafi, Adel A. Elbaset, 2022-09-15 *Modern Optimization Techniques for Smart Grids* presents current research and methods for monitoring transmission systems and enhancing distribution system performance using optimization techniques considering the role of different single and multi objective functions The authors present in depth information on integrated systems for smart transmission and distribution including using smart meters such as phasor measurement units PMUs enhancing distribution system performance using the optimal placement of distributed generations DGs and or capacitor banks and optimal capacitor placement for power loss reduction and voltage profile improvement The book will be a valuable reference for researchers students and engineers working in electrical power engineering and

renewable energy systems Predicts future development of hybrid power systems Introduces enhanced optimization strategies Includes MATLAB M file codes Modern Optimisation Techniques in Power Systems Yong-Hua Song,1999-05-31 Under an ever increasingly competitive deregulated environment power utilities need efficient and effective tools to ensure that electrical energy of the desired quality can be provided at the lowest cost These usually form highly constrained optimisation problems Modern Optimisation Techniques in Power Systems is the first book to offer a comprehensive cover of major modern optimisation methods applied to power systems including simulated annealing tabu search genetic algorithms neural networks fuzzy programming Lagrangian relaxation interior point methods ant colony search and hybrid techniques Various applications and case studies are presented to demonstrate the potential and procedures of applying such techniques in solving complex power system optimisation problems Written by top international experts in this field this book will be a useful reference for professional engineers and managers involved in the optimisation of power system operation It will also be of interest to postgraduates and researchers **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 Reliability Analysis of Modern Power Systems R. K. Saket,Sanjeevikumar Padmanaban,2024-09-04 A reader friendly introduction to reliability analysis and its power systems applications The subset of probability theory known as reliability theory analyzes the likelihood of failure in a given component or system under given conditions It is a critical aspect of engineering as it concerns systems of all kinds not least modern power systems with their essential role in sustaining the technologies on which modern life relies Reliability Analysis of Modern Power Systems is a thorough accessible book introducing the core concepts of reliability theory as they apply to power systems engineering as well as the advanced technologies currently driving new frontiers in reliability analysis It is a must own for anyone looking to

understand and improve the systems that power our world Readers will also find Detailed discussion of reliability modeling and simulation of composite systems using Typhoon HIL 404 Reliability assessment of generation systems transmission systems distribution systems and more Information on renewable energy integration for more sustainable power grids Reliability Analysis of Modern Power Systems is ideal for professionals engineers and researchers in power system design and reliability engineering as well as for advanced undergraduate and graduate students in these and related subjects

Applying Particle Swarm Optimization Burcu Adıgüzel Mercangöz,2021-05-13 This book explains the theoretical structure of particle swarm optimization PSO and focuses on the application of PSO to portfolio optimization problems The general goal of portfolio optimization is to find a solution that provides the highest expected return at each level of portfolio risk According to H Markowitz s portfolio selection theory as new assets are added to an investment portfolio the total risk of the portfolio s decreases depending on the correlations of asset returns while the expected return on the portfolio represents the weighted average of the expected returns for each asset The book explains PSO in detail and demonstrates how to implement Markowitz s portfolio optimization approach using PSO In addition it expands on the Markowitz model and seeks to improve the solution finding process with the aid of various algorithms In short the book provides researchers teachers engineers managers and practitioners with many tools they need to apply the PSO technique to portfolio optimization

Control Applications in Modern Power Systems Arvind Kumar Prajapati,Manoj Tripathy,Asheesh K. Singh,Vijay K. Sood,Om P. Malik,2025-03-24 The book titled Control Applications in Modern Power System select proceedings of EPREC 2024 delves into in depth discussions case studies and recent advancements within the burgeoning field of control systems It specifically focuses on areas such as load frequency control wide area monitoring control and instrumentation optimization intelligent control energy management systems and SCADA systems The development of effective control strategies plays a pivotal role in managing reactive power and upholding voltage profiles among other critical aspects Readers stand to gain valuable insights bolstering their knowledge and expertise in these domains Furthermore this book has the potential to inspire fresh and innovative ideas Whether a newcomer a researcher or a seasoned professional this book serves as an invaluable reference for all for staying abreast of the latest developments in control systems

Bio-Inspired Computational Intelligence and Applications Dr. Kang Li,2007-08-28 This book is part of a two volume work that constitutes the refereed proceedings of the International Conference on Life System Modeling and Simulation LSMS 2007 held in Shanghai China September 2007 Coverage includes advanced neural network theory advanced evolutionary computing theory ant colonies and particle swarm optimization intelligent modeling monitoring and control of complex nonlinear systems as well as biomedical signal processing imaging and visualization

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