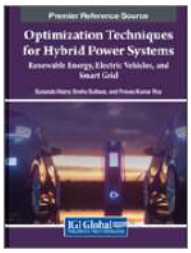

Optimization Techniques for Hybrid Power Systems: Renewable Energy, Electric Vehicles, and Smart Grid

Sunanda Hazra, Sneha Sultana, Provas Kumar Roy

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Description:

Optimization Techniques for Hybrid Power Systems: Renewable Energy, Electric Vehicles, and Smart Grid is a comprehensive guide that delves into the intricate world of renewable energy integration and its impact on electrical systems. With the current global energy crisis and the urgent need to address climate change, this book explores the

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Optimization Techniques for Hybrid Power Systems: Renewable Energy, Electric Vehicles, and Smart Grid is a comprehensive guide that delves into the intricate world of renewable energy integration and its impact on electrical systems. With the current global energy crisis and the urgent need to address climate change, this book explores the latest advancements and research surrounding optimization techniques in the realm of renewable energy.

This book has a focus on nature-inspired and meta-heuristic optimization methods, and it demonstrates how these techniques have revolutionized renewable energy problem-solving and their application in real-world scenarios. It examines the challenges and opportunities in achieving a larger utilization of renewable energy sources to reduce carbon emissions and air pollutants while meeting renewable portfolio standards and enhancing energy efficiency.

This book is explored as a crucial recipe for modern power system processes and management. The integration of energy storage, distributed generation, demand response, and thermally activated technologies into electric distribution and transmission systems is examined in detail. The book also emphasizes the importance of smart-grid technology, artificial intelligence (AI), and advanced multi-energy systems in achieving sustainability and carbon neutrality.

This book serves as a valuable resource for researchers, academicians, industry delegates, scientists, and final-year master's degree students. It covers a wide range of topics, including novel power generation technology, advanced energy conversion systems, low-carbon technology in power generation and smart grids, AI-based control strategies, data analytics, electrified transportation infrastructure, and grid-interactive building infrastructure.

Coverage:

The many academic areas covered in this publication include, but are not limited to:

- Advanced Multi-Energy-Based Hybrid System
- AI Software Tools and Platforms
- AI-Based Decision-Making Process
- Artificial Intelligence
- Data Analytics in Generation, Transmission and Consumption
- Electrified Transportation Infrastructure
- Energy Cascade Conversion System
- Energy Infrastructure with Energy-Efficient Functionalities
- Energy Management Strategy
- Grid-Interactive Building Infrastructure
- Low Carbon Technology in Power Generation
- New Equipment and Devices for Emission Reduction
- Novel Power Generation Technology
- Renewable Energy
- Smart Energy
- Smart Grid

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infrastructure adoption.

Chapter 7

Optimal Tuning of Single Input Power System Stabilizer Using Quasi-Oppositional Butterfly Optimization Algorithm

Sourav Paul, Sneha Sultana, Provas Roy, Chandan Paul, Tushnik Sarkar, Susanta Dutta, Poulomi Acharya

Low frequency oscillation has been a major threat in large interconnected power system. These low frequency oscillation curtains the power transfer capability of the line, thereby affecting the small signal analysis of the system and hence the performance of the system comes to a stake. Power System Stabilizer (PSS) helps in diminishing these low frequency oscillations by providing auxiliary control signal to the generator excitation input. In this chapter, the authors have incorporated the concept of quasi-oppositional based learning (OBL) in butterfly optimization algorithm (BOA) to solve PSS problem. The proposed technique have been implemented on SMIB system and the supremacy of the suggested QOBOA accept been accurate by different loading conditions to show the flexibility of QOBOA. The computed results thus obtained by the proposed techniques have been verified by comparing the results with those obtained by well published algorithm. The convergence characteristics as well authenticate the sovereignty of the considered algorithms.

Chapter 8

Effective Planning of Renewable Energy System: Solar Radiation Prediction Case Study in Telangana State, India Using Machine Learning Approach

Ansar Shaik Satuluru, Shakila Baskaran, Prakash Marimuthu

The energy demand crisis is being faced by all the nations, due to the rapid growth of the global economy. The conventional resources available on the earth are finite. Burning these fossil fuels abundantly results in large-scale greenhouse gas emissions and significant environmental contamination. The generation of electricity using renewable energy sources has increased significantly in recent years. However, the power generation using renewable energy sources like solar, wind etc., is weather dependent and highly erratic. In order to maintain system stability and to use renewable energy resources effectively, renewable power forecast is essential. For the effective planning of power network, three different machine learning algorithms i.e., Linear Regression (LR), Decision Tree Regression (DTR) and Random-Forest Regression (RFR) are used for predicting the solar radiation in Mahabubnagar, Telangana. All the three regression algorithms are evaluated in terms of statistical measures; Random-Forest Regression algorithm provides best results.

Chapter 9