Preface

Nowadays, energy is a critical component of human life; a reliable supply of energy to customers increases their standard of living and comfort. The efficient and secured operation of the electrical power system meets the energy requirements of the customers. The power system serves as the most efficient medium for transferring energy from one area to another. The power system is made up of a number of power generating resources, a complicated power transmission network, and a complex distribution system. As the demand for energy grows at an alarming rate, the power system infrastructure becomes increasingly strained and fragile. The integration of renewable energy sources into the conventional power system complicates its operation and control. The growth of information and communication technology (ICT) has created opportunities in the electrical power system by making it smart and intelligent. Integrating ICT with conventional power systems improves reliability and customer service.

As we all know, the electrical power system is growing geographically much dispersed, making manual operation and control more difficult. To address the challenges of human operation and control of power systems, automation under the name of energy management system (EMS) is taking place to make power systems more stable. With the advancement of Artificial Intelligence (AI) and Machine Learning (ML) technology, numerous efforts are being made to augment the EMS of power systems in order to make them more intelligent. Many efforts are made in this book to establish various approaches and methods to make power systems smart utilizing artificial intelligence. This book assists the power system community in comprehending the numerous technological advancements occurring in the use of AI and ML for energy management. Chapters Organization and Topics Covered are as follows.

Chapters 1-5 discuss the applications of Blockchain, Internet of Things, Artificial Intelligence, and Machine Learning in improving power system grid stability and security in the presence of renewable energy sources. The future of Digital Twin Technology and smart meter applications have also been addressed.

Chapters 6-11 provide an overview of the most recent operation and control strategies for power distribution systems, such as Integrated Demand Response, Smart Distribution Network using Transactive Energy Systems, and ML Algorithm Applications on Microgrid.

Chapters 12-17 deal with the development of the state of the art optimization algorithm for energy harvesting and improving the efficiency of wind energy. The application of Big data analytics for cyber physical system and high-speed data transfer in satellite communication system using PLC and cloud computing is presented.

Chapter 18-20 explore the techniques for Effective Power Monitoring, Exploratory Data Analysis and Energy Predictions with Advanced AI and ML Techniques. An overview about the impact of Electronic Power Aging on Implantable Antennas was also discussed.

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