



Design of Smart Power Grid Renewable Energy Systems

By Ali Keyhani

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To address the modeling and control of smart grid renewable energy system into electric power systems, this book integrates three areas of electrical engineering: power system engineering, control systems engineering and power electronics. The approach to the integration of these three areas differs from classical methods. Due to complexity of this task, the author has decided to present the basic concepts, and then present a simulation test bed in matlab to use these concepts to solve a basic problem in development of smart grid energy system. Therefore, each chapter has three parts: first a problem of integration is stated and its importance is described. Then, the mathematical model of the same problem is formulated. Next, the solution steps are outlined. This step is followed by developing a matlab simulation test bed. Each chapter ends with a set of problems and projects. The book is intended be used as textbook for instruction or by researchers. This book can be used as undergraduate text for both electrical and mechanical engineers. The prerequisite for the course is a course in fundamental of electrical engineering.

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Editorial Review

Review

"I highly recommend the revolutionary and landmark book Design of Smart Power Grid Renewable Energy Systems by Ali Keyhani, Ph.D., to anyone who is serious about an integrated systems approach to the design and development of smart power grids and microgrids, and an richer understanding of the mathematical basis for the system. This book is a powerful textbook for any students seeking a career in the crucial smart power grid, microgrid technology, and green energy fields." (Blog Business World, 19 October 2011)

From the Back Cover

The first guide to the Design and modeling of smart grid energy systems

As we begin the second decade of the 21st century and approach the problem of global warming, we need to accept a fundamental change in how we create, generate, distribute, and use energy. Creating sustainable energy, thereby reducing or eliminating our carbon footprint and efficiently utilizing available energy resources, is of vital importance. Smart grid renewable energy systems are a revolutionary concept in electrical engineering designed to allow end users control over their individual energy needs by providing them with the means to create, maintain, and distribute energy.

Design of Smart Power Grid Renewable Energy Systems uniquely addresses the design and modeling of smart grid renewable energy systems by integrating three areas of electrical engineering: power system engineering, power electronics, and electric energy conversion systems—with an approach that differs from classic methods. After a brief overview of energy and its evolution to electric power, the author introduces the basic concepts behind power grids, then takes an in-depth look at the modeling of converters in power grid distributed generation systems and the design of a smart power grid system. Microgrid photovoltaic and wind energy systems are addressed as renewable energy sources. Load flow analysis of power grids and microgrids, and power grid fault studies are the subjects of the text's final chapters.

In each chapter, Dr. Keyhani presents a key engineering problem and subsequently formulates a mathematical model of the problem followed by a simulation testbed in MATLAB®, highlighting solution steps. Each chapter includes a number of solved examples, problems, and related references.

Design of Smart Power Grid Renewable Energy Systems is written as an undergraduate/graduate textbook for introducing renewable energy sources and the basic concept of smart power grids for students in electrical and mechanical engineering. The book is also a useful reference tool for researchers and energy policy makers.

About the Author

Ali Keyhani, PhD, is a Professor in the Department of Electrical and Computer Engineering at The Ohio State University. He is a Fellow of the IEEE and a recipient of The Ohio State University, College of Engineering Research Award for 1989, 1999, and 2003. He has worked for companies such as Columbus and

Southern Electric Power Company, Hewlett-Packard Co., Foster Wheeler Engineering, and TRW. He has performed research and consulting for American Electric Power, TRW Control, Liebert, Delphi Automotive Systems, General Electric, General Motors, and Ford. Dr. Keyhani has authored many articles in IEEE Transactions in Energy Conversion, Power Electronics, and Power Systems Engineering.

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