wind integration

a very timely second edition

AS THIS ISSUE IS ABOUT WIND integration, it is fitting that the book reviewed in this issue is also on this topic. *Wind Power in Power Systems*, according to the reviewer, "is a very well-edited update to the previous edition, which was already one of the more thorough overviews of wind integration issues."

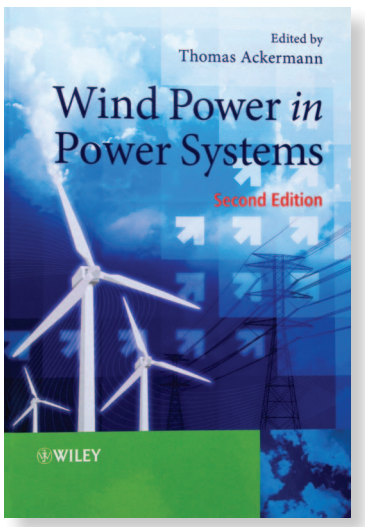
Wind Power in Power Systems

By Thomas Ackermann, Ed., second edition

This second edition of *Wind Power in Power Systems* is an update to the 2005 version, which provided a very comprehensive overview of the state of wind generation integration at that time. It has been significantly expanded from 29 to 44 chapters; additionally, many chapters have been updated to reflect recent experience and developments. The new edition is very timely given the significant experience obtained throughout the world in the past few years. Indeed, much of the new material considers aspects of wind integration that have become more prominent. Additionally, the chapters on experience to date give a very useful practical insight into the types of challenges expected and how they have been overcome.

As an introduction to wind interconnection and wind integration, this book will be extremely useful, either for those who are new to the subject and need to get up to date or as an excellent reference for those experienced in the area. Its mix of fundamental aspects of wind generation technology and wind interconnection and integration, together with newer topics related to specific challenges for wind in power systems, ensures that it covers most, if not all, relevant aspects.

The book is divided into seven parts, as well as a preface chapter that clears up many of the most common "myths" relating to integration of wind energy and offers a good summary of many of the issues explored later in more detail. Splitting the book into several parts makes it easier to navigate, as each section comprises a different theoretical study or wind integration experience perspective. The increase in the number of sections compared to the previous edition is necessary due to the addition of a large number of new chapters, particularly relating to wind integration studies, technical regulations, and transmission issues.



Part A gives a theoretical background, including an introduction to wind turbine technology, focusing on those characteristics most related to power system operations and planning. It also describes the historical development and current status of wind power, introduces the basic integration issues, and the power system impacts and value of wind power.

Part B has five chapters relating to technical regulations and grid codes. This provides a reader with enough information to better understand this important aspect of wind integration, addressing both theoretical background and practical experience, together with a description of current standards worldwide. Part C moves onto wind power plant design and various transmission-related issues related to wind energy, with a particular focus on offshore wind technology and transmission requirements.

Many new chapters are related to studies that have been carried out in the years since the last edition; these are contained in Part D. This is a very useful overview of many of the most important studies in the last few years. Both the United States and Europe have seen a significant number of large studies, and these are described here as well as other studies relating to issues such as transmission capacity and energy storage. As with all of the other parts of the book, each chapter provides a good reference list of the relevant papers and reports related to each topic.

The largest part of the book is Part E, which may be the section that has most practical relevance for those new to the area. Here, experience from those regions worldwide with the highest penetrations of wind power, as well as some with lower wind penetration but with interesting experiences, are each given a chapter. This illustrates

Digital Object Identifier 10.1109/MPE.2013.2276200
Date of publication: 18 October 2013

the wide variety of challenges related to wind integration and puts much of the remaining technical content in the book into context. This part of the book will be very useful to readers in areas with lower but increasing wind penetrations; while no two regions are the same, the breadth of regions covered here means most or all of the main integration issues are covered.

The next part of the book gives an extremely useful treatment of dynamic stability issues relating to wind power, from the modeling of individual wind turbines and wind parks to impacts on power system dynamic performance. As with other parts, this part gives an overview of the theoretical underpinnings, including equations and example calculations, and then shows how the system is impacted, as well as mitigating strategies. The final part of the book collects a number of unrelated chapters on future issues; as this is an area with little practical experience, this will be of most interest to students and researchers compared to practicing engineers.

As the editor notes in his introduction, there is some overlap, and sometimes even different opinions, on several matters in the chapters. However, the more experienced reader will note that this reflects many of the current debates in industry, relating to aspects such as grid code development, market rules, and the need for new flexible resources. It also reflects some differences between system and market configurations in the United States and Europe, from which the experience and studies for wind integration are obtained, as well as different approaches from academia and industry.

One potentially useful addition would be a discussion of the overlaps between wind energy and other renewable resources, particularly solar generation; this is hinted at a few times in the book, but the significant overlaps are not covered in detail. In many chapters, the work laid out represents reporting of industry efforts, such as IEEE working groups or International Energy Agency task forces. This ensures that the most relevant people in the field are writing about the topic.

I found this book to be a very well-edited update to the previous edition, which was already one of the more thorough overviews of wind integration issues. The book is well laid out, with each part tackling a specific topic. While eventually updates will be needed based on new experience, this book will remain relevant for at least most of the rest of this decade. I would recommend this book for anyone who has an interest in wind integration issues, from graduate students to practicing engineers and researchers; in many cases, I would recommend this book even for those who own the previous edition, as it is such a significant upgrade.

—Aidan Tuohy