

Book Reviews

Applied Mathematics for Restructured Electric Power Systems—Edited by Joe H. Chow, Felix F. Wu, and James A. Momoh (New York: Springer Science Business Media, 2005). *Reviewed by Vijay Vittal*

I. INTRODUCTION

This edited volume is a collection of invited papers presented at a workshop entitled “Applied Mathematics for Deregulated Power Electric Power Systems: Optimization, Control, and Computational Intelligence,” and sponsored by the National Science Foundation. The objective of this workshop was to discuss the use of new mathematical tools, such as those developed in control, optimization, and computational intelligence, for applications to power system problems and identify new research directions. The main topics presented in the workshop can be divided into the following three broad categories:

- 1) problems in power system analysis;
- 2) problems in power system control;
- 3) issues related to computational intelligence.

II. CONTENTS OF THE BOOK

The book contains 13 chapters contributed by several participants. Chapter 1 of the book, written by the editors, sets up the objectives of the workshop and provides a brief introduction to each of the contributions in the book. Chapters 2–5 address problems related to power system analysis.

The first contribution in Chapter 2 is an introduction to the topic of reactive power. The concept of reactive power is introduced from first principles. The presentation will also appeal to a non technical reader. A simple example is developed to illustrate the concept of voltage stability and the role of reactive power. Several important challenges in voltage control and related security are identified and discussed. The basic premise is clearly laid out and the critical research issues are outlined.

Chapter 3 presents an approach developed in conjunction with several industry participants to identify weak locations with regard to voltage stability in large power systems. The technique is developed using a simplified two-node network with several simplifying assumptions. The application of the approach on a portion of a realistic system is presented. Future steps to extend the approach by relaxing some of the simplifying assumptions are proposed. The chapter, however, does not discuss the main analytical issues that need to be addressed nor does it identify the major computational issues that need to be addressed to extend the approach to large power systems.

Some recent efforts in integrated voltage stability and oscillatory stability assessment using a bifurcation and manifold based approach are described in Chapter 4. The techniques are described in some detail and specific applications of these techniques are identified. Several important research issues related to voltage security and cost of power system security are also identified.

A detailed description of a tool to perform online available transfer capability evaluation is described in Chapter 5. This tool

includes thermal, voltage, and transient stability limits. Some results obtained from the tool are also presented. No specific research needs are identified in this chapter which was a primary goal of the workshop.

Chapters 6–9 discuss problems related to power system control. An extension of the hierarchical control approach to design automation, and management of the system over broad changes in system operating conditions and status of equipment is presented in Chapter 6. This chapter then presents several ideas dealing with modeling, system constraints, estimation and control, using this multilayered approach. The objective of the proposed approach is presented and a few open questions are posed without much specificity.

Chapter 7 presents certain key ideas regarding the use of linear matrix inequalities for designing decentralized robust controllers. Some interesting new ideas on the use of decentralized static-output feedback and information exchange are proposed and outlined in some detail. This will provide graduate students working in this area a good overview of the issues involved.

Interesting new ideas on the use of signal-based approaches for real-time detection of impending instability are proposed in Chapter 8. The concept of a precursor-based monitoring is presented and described. Some specific challenging problems for large scale power systems are identified and discussed. This is a topic of interest in large scale power systems and is a topic of great relevance with the advent of wide areas monitoring capabilities that exist today.

Innovative new concepts dealing with dynamic embedded optimization and shooting methods for power systems are presented in Chapter 9. These ideas are developed using a Hybrid systems framework. The analytical framework is clearly laid out and some important research challenges relating to complex power systems are identified and outlined. In terms of a comprehensive approach to power system control, incorporating both the control subsystem and the protection subsystem, the ideas proposed have significant potential to impact future operational concepts.

Chapters 10–13 cover various aspects of computational intelligence applied to power systems. Of the three major sections in the book, this section does not make a significant contribution to the main objective of the workshop which was to identify future research directions. The chapters largely present some excellent work done by the authors in their respective areas of expertise but do not educate the researchers in the area with regard to primary research issues in these areas, the significant analytical complexity, and the nature of the solutions needed.

In Chapter 10, several results generated by the authors pertaining to the use of neurocontrollers to control flexible AC transmission system (FACTS) devices are presented. The chapter provides models for these devices which have been well documented in the literature. In addition, several of the authors’ results are provided in detail along with simulation results. The section on future research simply states what the authors intend to do in the future without clearly identifying the outstanding problems in the area, future research directions, and issues relating to implementation in power systems.

Chapter 11 introduces a framework for the use of Metaheuristics in the placement and tuning of power system controllers. Two excellent examples developed by the authors relating to the siting of switching and protection devices in a distribution system, and to the coordinated tuning of supplementary damping controllers for FACTS devices are

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presented. The chapter, however, does not provide sufficient details regarding new research directions and the outstanding analytical issues in the area.

Load forecasting is the topic addressed in Chapter 12. The authors provide a fairly detailed summary of the state of the art in the area and the nature of the techniques currently in use. A section on future research directions is provided. This section however, is too general and does not provide sufficient information regarding the nature of the techniques needed and the possible avenues that can be explored.

The last chapter in the book deals with the development of the independent component analysis approach to estimate various load components in the power system. The approach is clearly laid out and demonstrated with some excellent examples. The section on future research directions points out to several areas that the authors intend to pursue however, no indication of the overarching issues, relevance of the approach, and major technical obstacles is provided.

III. SOME CONCLUDING OBSERVATIONS

As indicated previously, several chapters in the book meet the stated objectives of the workshop and clearly identify new areas of research in the stated topics. However, there are several chapters that simply outline research done by the authors and do not provide any direction for future research. The book would be useful to graduate students starting their research in these various areas, and will help provide some direction and identify topics to consider in the areas of power system analysis, power system control, and computational intelligence applied to power systems.

This could be a useful document to beginning students. However, the presentation in the various chapters is not uniformly of high quality. Some chapters provide useful insight with sufficient technical details. On the other hand, there are certain chapters which simply restate existing results produced by the authors and do not sufficiently address the objectives of the workshop.

What Is a Book Review? Traditionally, book reviews are written evaluations of a recently published book in any genre. Usually around the 500 to 700 word mark, they offer a brief description of a text's main elements while appraising the work's overall strengths and weaknesses. Published book reviews can appear in newspapers, magazines, and academic journals. They provide the reader with an overview of the book itself and indicate whether or not the reviewer would recommend the book to the reader. Writing a book review is something that can be done with every novel. Book reviews can apply to all novels, no matter the genre. Some genres may be harder than others. On the other hand, the book review format remains the same. Take a look at these step-by-step instructions from our professional writers to learn how to write a book review in-depth. How to write a book review step-by-step. Step 1: Planning. Create an essay outline which includes all of the main points you wish to summarise in your book analysis. A book review is a summary of a book that you have read. You should review all aspects of the story. A book review is therefore written after reading (you may always order review at writing service without reading a book) because without reading the book it is difficult to figure out what it is all about and the review will, therefore not make sense. A wide reader will have an easy time in book review writing. This article highlights the guidelines for review writing. Content of this article. Preparations.