Preface

Power System Operations provides an introduction to power system modeling, power system steady-state analysis, power system estimation, power system security, and electricity markets.

Specifically, this book covers the analysis of three-phase circuits, the modeling of power system components, the power flow problem, the power system state estimation problem, and the analysis of power system operation security. It also provides an overview of electricity markets, including the unit commitment, the economic dispatch, the self-commitment, and the market clearing problems.

The book embodies a problem-solving approach resulting in an up-to-date analysis of the most important problems in power system operations, and it includes many illustrative examples to clarify the power engineering concepts covered.

This textbook is intended for advanced undergraduate and graduate teaching in power engineering and other engineering disciplines. It is also useful for industry practitioners since it provides many practical examples developed up to working algorithms.

This book consists of eight chapters and two appendices.

Chapter 1 provides an introduction to power systems, describing its physical, economic, and regulatory layers, as well as the way in which such systems are operated. It also describes how power markets work. Finally, it summarizes the contents of the book.

Chapter 2 reviews the analysis of three-phase circuits and defines three-phase voltages and currents; three-phase active, reactive, and apparent powers; and the per-unit systems. This chapter provides an appropriate background of three-phase power for the unfamiliar reader, establishing the link between the physical reality and analytical techniques. It can be skipped by readers with knowledge of three-phase circuit analysis.

Chapter 3 provides steady-state models for the most common components of a power system, namely, generators, motors, transformers, lines, and loads.

Chapter 4 addresses the power flow problem, including nodal equations, admittance matrix, power flow equations, solution techniques, and result analysis.

Chapter 5 considers the state estimation problem and includes its formulation, solution techniques, observability analysis, and bad measurement detection and identification.

Chapter 6 addresses the formulation and solution of operation security problems, including the optimal power flow and the security-constrained optimal power flow.

Chapter 7 considers a centralized market operation and provides formulation and solution techniques for the unit commitment, the economic dispatch, and the network-constrained unit commitment problems.

Chapter 8 considers a non-centralized market operation and addresses the self-scheduling problem and the formulation of market clearing algorithms.

Finally, Appendix A reviews the solution to nonlinear systems of equations, while Appendix B provides an introduction to optimization techniques.

The material in this book fits the needs of an advanced undergraduate or graduate course on power system operations. Chapters 1 and 2 may be skipped if the students are familiar with the analysis of power circuits. Chapters 7 and 8 may be skipped if the economic operations of power systems do not need to be covered.

The book provides an adequate blend of engineering background and analytical methods. This feature makes the book of interest to practitioners as well as to students in power engineering and other engineering fields. Practical applications are developed up to working algorithms (coded in GNU Octave and GAMS) that can be readily used.

The benefits of reading this book include comprehension of power system operation problems, and learning how to formulate such problems, solve them, and interpret their solution outputs. This is done using a problem-solving engineering approach.

To conclude, we would like to thank our colleagues and students at The Ohio State University and Universidad de Castilla–La Mancha for their insightful observations, pertinent corrections, and helpful comments.

Columbus, Ohio, USA — Antonio J. Conejo
Ciudad Real, Spain — Luis Baringo
June 2017

http://www.springer.com/978-3-319-69406-1

Power System Operations
Conejo, A.J.; Baringo, L.
2018, XIII, 296 p. 109 illus., Hardcover
ISBN: 978-3-319-69406-1