Preface

"... I repeat that you must lay aside all prejudice on both sides, and neither believe nor reject any thing because any other person, or description of persons have rejected or believed it. Your own reason is the only oracle given you ..."

—Thomas Jefferson, letter to his nephew, Peter Carr, August 10, 1787.

Electric power systems are a vital part of modern life. We are reminded of this whenever there is a significant blackout in any of the world's developed economies. Even in countries that have a minimal reliance on electricity, we see the powerful impact of supply disruptions on the quality of daily life. The development of new technologies, including new forms of electric power generation and storage and new mechanisms to regulate the flow of power, is having an enormous impact on power systems large and small. New and more widespread applications of electric power such as vehicle propulsion and distributed and remote generation continue to expand.

Society has become increasingly reliant on electric power and consequently more vulnerable to service breakdowns. Recent events worldwide have brought with them the startling realization that civil infrastructure systems are vulnerable to assault by small organized groups with malicious intent. Whereas power systems have traditionally been designed with a focus on protecting them from routine component failures and atypical user demand, we now also confront the fact that deliberat attacks intended to cause maximum disruption are a real possibility.

In response to this changing environment, new concepts and tools have emerged that address many of the issues facing power system operation today. This book is aimed at introducing these ideas to practicing power system engineers, control system engineers interested in power systems, and graduate students in these areas.

This book is intended to provide sufficient information about power system modeling and behavior, so that a control engineer without a background in power systems can think coherently about power system control. But it is not intended to

duplicate the material that would be found in a traditional power system course. Similarly, the control system material is intended to provide a power system engineer with sufficient information about new and emerging control-theoretic ideas to encourage their application to power systems. But the material covered is far from standard fare in a control system plan of study.

This book is focused on two main themes: the nonlinear dynamics of power systems, and the discrete event mechanisms that are a dominating factor in power system operations. Stability, voltage collapse, power transfer limits, power flow oscillations, and other important aspects of power system behavior have been elucidated through the application of advances in dynamical systems and nonlinear control theory. The interaction of discrete protection systems and control actions such as load shedding with the nonlinear continuous dynamics of the system are central to the behavior of power systems, especially during emergencies. New methods of modeling, analysis, and design of such *hybrid* systems continue to be a central theme of present-day control systems research. In this work, we examine these ideas and consider how they can be applied to improve our understanding of power system behavior and how they can be used to design better control systems.

This book is supplemented by a software (Mathematica) package that will enable the reader to work out nontrivial examples and problems. Also available is a set of tutorial Mathematica notebooks that provide detailed solutions of the worked examples in the text. Besides Mathematica, simulations are carried out using Simulink with Stateflow. These can all be obtained at the Web site http://www.pages.drexel.edu/~hgk22/.

The authors are fortunate to have had the opportunity to participate in research aimed at improving power system operations. Support over many years from the National Science Foundation, Department of Energy, Middle Atlantic Power Research Council, Electric Power Research Institute, and the Office of Naval Research is gratefully acknowledged. Many individuals have influenced our view of power systems. We are indebted to all of them.

http://www.springer.com/978-0-8176-4673-8

Power System Dynamics and Control
Kwatny, H.G.; Miu-Miller, K.
2016, XI, 271 p. 112 illus., Hardcover
ISBN: 978-0-8176-4673-8
A product of Birkhäuser Basel