Power Systems Engineering Research Center

Voltage Recovery and Optimal Allocation of VAR Support via Quadratic Power System Modeling and Simulation

Georgios K. Stefopoulos
Ph.D. Candidate, School of Electrical and Computer Engineering
Georgia Institute of Technology

May 5, 2009
2:00-3:00 p.m. Eastern Time (11:00-12:00 p.m. Pacific)

Description:

Voltage instabilities have been a major increasing concern for power system operations and control. Voltage instabilities occur during system swings, inadequate VAR support, fault induced delayed voltage recovery, etc. Load dynamics is an important contributing factor to voltage instabilities. During a system disturbance these phenomena can lead to protective relaying operations that further aggravate the disturbance. The prognosis of voltage problems and mitigation of voltage instabilities is a complex problem. This talk will describe recent work that resulted in advanced methods for mitigation of voltage related phenomena. The talk will characterize voltage instability phenomena and will present a new approach for advanced simulation methods of voltage-recovery phenomena using improved, realistic system models and accurate solution techniques and mitigation methods for improved voltage recovery. The important issue of load dynamics and their impact on voltage stability is addressed.

A general framework for power-system analysis is presented the main characteristics of which are (a) utilization of full three-phase models, and (b) use of a “quadratized” mathematical formulation, which models the system under study as a set of mathematical equations of order no more than two. Accurate modeling and simulation of voltage-recovery phenomena allows the development of mitigation methodologies via the optimal allocation and operation of static and dynamic VAR resources over the planning horizon. This problem is solved with successive dynamic programming techniques with the following two innovations: (a) the states at each stage (candidate solutions) are obtained with static and dynamic (trajectory) sensitivity analysis and (b) each candidate solution is evaluated by considering the optimal operation of installed static and dynamic VAR sources utilizing concepts from the theory of applied optimal control and trajectory optimization. Example results will be provided.

Biography: George Stefopoulos is a Ph.D. candidate at the School of Electrical and Computer Engineering of the Georgia Institute of Technology. He was born in Athens, Greece in 1977. He received the Diploma in Electrical and Computer Engineering from the National Technical University of Athens, Greece, in 2001 and the M.S. degree in E.C.E. from the Georgia Institute of Technology, Atlanta, GA, U.S.A., in 2002. He is currently completing his Ph.D. degree at Georgia Tech under the supervision of Professor A. P. Meliopoulos. He is a member of IEEE, SIAM, the IET, and the Technical Chamber of Greece.

Speaker Contact Information
Georgios Stefopoulos
gs121@mail.gatech.edu

Participation by Webcast: You can participate in PSERC tele-seminars via webcast. Before the tele-seminar, click here and then on 5/5/09 when the status is "In Progress." Note that the web page at that address does not automatically refresh. The webcast will include the audio and the slides so you will not have to download the slides in advance. If you want to ask questions, you should register for participation by phone.

Registration for Webcast Participation: None required. There is no charge for participating!

Participation by Phone: Live audio will also be provided via a teleconference phone bridge. After registering, you will be sent connection information for the conference phone bridge. You will need to download the presentation slides in advance of tele-seminar. The presentation slides will be posted on May 5 on the PSERC website. The archived audio-slide production of the tele-seminar will be available for webstreaming after the tele-seminar.

Registration for Phone Participation: To indicate that your organization would like to have a phone access line, send an email to Theresa.Herr@asu.edu with the subject "Stefopoulos Seminar". To use our limited phone bridge capacity efficiently, we ask that people within an organization participate together rather than calling in separately, if at all possible. Connection information will be sent before the tele-seminar. There is no charge for participating!

Professional Development Hour Certification: PDH certification is available for PSERC members (only). Send an email requesting PDH certification to Theresa.Herr@asu.edu with the subject "PDH" after the seminar. *Include the name and title of each participant.*

Tele-Seminar Logistics and Assistance
Connection information will be emailed to you about three business days before the tele-seminar. If you have any questions, please contact Theresa Herr, PSERC's administrative assistant, at 480-965-1643 or Theresa.Herr@asu.edu. You can also contact Dennis Ray, PSERC Executive Director, at 608-265-3808 or djray@engr.wisc.edu.

PSERC's Tele-Seminar Coordinator
Shmuel Oren, University of California at Berkeley
Email: oren@ieor.berkeley.edu

Shmuel welcomes feedback on the tele-seminars and suggestions for future ones.