

Reliability Analysis of Systems with Non-Dispatchable Generation

9 am - noon and 2 - 5 pm, June 10, 2012

Program: Recent emphasis on renewable generation resulted in the development and deployment of generating resources that are non-dispatchable, such as wind and PV. The penetration levels of these technologies are expected to increase as environmental and safety concerns tend to penalize the conventional generating resources. Non-dispatchable generating resources are also characterized with a substantial level of availability uncertainty. The combination of non-dispatchability and uncertainty generates unique challenges in the operation of the electric power system and planning of the system to ensure proper reliability levels. This short course will provide a tutorial on reliability methods of electric power systems with substantial penetration of non-dispatchable resources. The course will cover the basic power system reliability methods (analytical, enumerative-failure and effect analysis, and Monte Carlo) and the application of these methods to systems with substantial wind and PV resources. The effect of operating procedures for these resources on the reliability of the system will be quantified. The reliability methods will be used to compute effective capacity credits of wind and PV systems as well as effects on the dispatchable generation fleet such as cycling of thermal units.

Topics:

- Reliability Models,
- Reliability Indices,
- Markov Models,
- Load Models,
- Forecasting,
- Failure and Effects Analysis,
- Monte Carlo Simulation,
- Probabilistic Production Costing,
- Operational Reliability,
- Cycling of Dispatchable Units,
- Capacity Credit for Non-Dispatchable Generation.

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Sakis (A. P.) Meliopoulos was born on March 19, 1949 in Katerini, Greece. He obtained a Diploma in Electrical and Mechanical Engineering from the National Technical University in Athens, Greece in 1972 and a Master in EE (1974) and a Ph.D. degree (1976) from the Georgia Institute of Technology in Atlanta, Georgia, USA. Dr. Meliopoulos' first professional association

was with Western Electric (1971) in Atlanta, Georgia. After receiving a PhD degree in 1976, he joined the faculty of the Georgia Institute of Technology as an Assistant Professor (1976), Associate Professor (1982-88) and full professor (1989-present). In 2006 Dr. Meliopoulos was named the Georgia Power Distinguished Professor. He is actively involved in education and research for improved safety and electromagnetic compatibility of electric power installations, protection and control of power systems and the application of new technology in these areas. Since 1999 he is the Georgia Tech site Director of PSERC, an NSF I/URC. Dr. Meliopoulos has pioneered several new analysis and design techniques for bulk power reliability analysis, safety, protection and electromagnetic compatibility of electric power systems. Most well known is the EPRI transmission reliability program TRELLS (now renamed TransCARE), the GPS-synchronized harmonic state measurement system for transmission systems (first wide area measurement system on NYPA and still operational - 1993), the distributed dynamic state estimation method (SuperCalibrator), his invention of the Smart Ground Multimeter, the EPRI grounding analysis programs, the WinIGS (Integrated Grounding System analysis and design), the GEMI (Grounding and ElectroMagnetic Interference) computer code, and the mGrid computer code – a methodology and implementation for precise analysis of multi-wire power systems with distributed energy resources. Dr. Meliopoulos has modernized many power system courses at Georgia Tech, introduced new courses, initiated the power system certificate program for practicing engineers and most importantly he has introduced visualization and animation methodologies that dramatically increase the teaching efficiency of complex power system concepts. Dr. Meliopoulos is a Fellow of the IEEE. He holds 3 patents, he has published two books, a chapter in the Standard Handbook for Electrical Engineers (87 pages) and over 250 technical papers. He has received a number of awards, including the Sigma Xi Young Faculty award (1981), the outstanding Continuing Education Award, Georgia Institute of Technology (2002), three of his papers have received the best paper award (IEEE-PES-SC-1984, IEEE-PES-EC-1987, and IEEE-CSS-HICSS 2002), he received the 2005 IEEE Richard Kaufman Award and the 2010 George Montefiore international award.