EPRI | ELECTRIC POWER RESEARCH INSTITUTE

GEARED

GridEd

The Center for Grid Engineering Education

Reliability Assessment of Distribution Systems

Live Online Course

Course Description

This course is part of an educational library of short courses developed and offered by GridEd. The course will focus on distribution reliability. Typical reliability indices are considered useful for distribution capacity planning, such as SAIFI, loss of load expectation, expected energy not supplied, and others. Computational methods of reliability indices are presented and introduction to commercial reliability software. In addition, causes of interruptions will be considered. Reliability modeling and reliability analysis methods are explored. The course closes out by examining several case studies.

Recent emphasis on renewable generation resulted in the development and deployment of generating resources that are non-dispatchable, such as wind and PV. Many of these resources are connected at the distribution level. 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.

Who Should Attend

The course is intended for distribution engineers or engineers needing to learn about distribution system reliability with a background in electrical engineering. Students should have some familiarity with distribution systems and equipment. Previous technical training is helpful but not necessary.

Registration Information

Dates:	March 4-7th, 2019 (Online) Monday-Thursday 1:00-4:00pm ET
Course Length:	4 days (12 hours Total)
PDH Available:	**12 Hours
Register at:	http://grided.epri.com/courses.html
Registration Fee:	

- $1,200 per person
- 20% discount for organizations with three or more attendees
- 25% discount for government employees (non-utility)
- 25% discount for university professors*
- 75% discount for graduate students*

*University IDs required to qualify for professor or graduate student discounts.

Location:

Online - Live sessions will be recorded and available following the live web conference.

Course Instructor:

Sakis Meliopoulos, Georgia Tech, sakis.m@gatech.edu

Roger Dugan, EPRI Subject Matter Expert, rdugan@epri.com

GridEd Operations Coordinator:

Amy Feser, afeser@epri.com

Email for discount code or questions.

Meet the Instructors

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, in troduced 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.

Roger C. Dugan, Life Fellow, IEEE, is a Sr. Technical Executive with EPRI in Knoxville, Tennessee USA. He has over 45 years of combined experience in distribution engineering with EPRI, Electrotek Concepts, and Cooper Power Systems. He holds the BSEE degree from Ohio University, Athens, OH, and the Master of Engineering in Electric Power Engineering degree from Rensselaer Polytechnic Institute, Troy, NY. Roger has worked on many diverse aspects of power engineering over his career because of his interests in applying computer methods to power system simulation. Beginning with a student internship with Columbus and Southern Ohio Electric Co. in 1971, his work has been mostly focused on Distribution Engineering. He was elected a Fellow of the IEEE in 2000 for his contributions in harmonics and transients analysis. He was very active in the development of software for harmonics analysis of distribution feeders beginning in 1975. He has also contributed to the solution of several special problems in transmission systems and was recently awarded a patent on a method for open-phase detection on EHV transformers in nuclear power plants. He has developed electromagnetic transients analysis tools for determining the internal voltage distribution of transformer windings for all types from distribution transformers up to large EHV power transformers. Recently, he has been very active in modeling of distributed energy resources, particularly as it applies to utility distribution systems and distribution system analysis. He is the creator of the OpenDSS computer program for power distribution system analysis. He was the 2005 recipient of the IEEE Excellence in Distribution Engineering Award. He is coauthor of Electrical Power Systems Quality published by McGraw-Hill, now in its 3rd edition. He serves on the IEEE PES Distribution System Analysis Subcommittee and is active in the Distribution Test Feeders WG.

Course Outline

Session 1

- **Introduction to Reliability**
- **Basic Reliability Concepts**
- **Repairable Processes (Equipment Reliability Models)**
- **Probability, Frequency and Duration Reliability Indices**

Session 2

- **Distribution System Reliability**
- **Distribution Reliability Measures**
- **Distributed Resource Reliability Modeling**
- **Techniques not Supported in OpenDSS**

Session 3

- **Analytical Reliability Methods**
- **Failure and Effects Analysis**
- **Monte Carlo Simulation**

Session 4

- **Example Study Cases**
- **Distribution System Reliability Indices Computation**
- **Wind Farm Reliability**
- **Data Center Reliability Analysis**
- **Effective Capacity Credits**

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