

## ***Expanded Tutorial Offering***

**What:** Technical Tutorials Covering a Variety of Power Engineering Topics

**Why:** A Special Offer in Conjunction with the 2008 PES General Meeting

**Who:** For IEEE Pittsburgh Section Members Only

**Where:** Pittsburgh, PA at the David Lawrence Convention Center

**When:** July 20-24, 2008

The IEEE PES is holding their General Meeting here in Pittsburgh this summer and eight technical tutorials are being presented. All of them offer the opportunity to earn PDH credits, which will be issued through IEEE headquarters. The course titles, CEU's, dates, sponsors, and brief summaries are shown below. More detailed descriptions can be found at the meeting website noted below. Registration for the General Meeting is NOT required for IEEE Pittsburgh Section members to attend one or more tutorials.

If you plan to register for and attend the General Meeting and will attend a tutorial, please utilize the PES meeting website to register on-line for tutorials and DO NOT use the registration form shown below. You can register for the conference and tutorials at the same time at <http://ewh.ieee.org/cmte/PESGM08/>.

If you DO NOT plan to attend the General Meeting but are interested in taking one or more of the tutorials, please fill out the registration form below and send it to the address indicated with a check payable to: "IEEE Pittsburgh Section". Prices are listed on the registration form.

### **T1 - Probabilistic T&D System Reliability Planning (0.8 CEU) Full Day Wednesday July 23<sup>rd</sup>** Presented by Power System Planning & Implementation Committee

This tutorial summarizes the of transmission and distribution systems reliability concepts and models that have been developed over the past forty years from the historical deterministic planning and design criteria to the movement towards the inevitable reliability based planning criteria and models. It presents the basic concepts and the recent developments in quantitative value based evaluation of T&D systems, and illustrates the practical applications of these techniques by utilities. The basic requirements of equipment outage and customer interruption cost data, and mathematical models in performing system reliability assessments are extensively covered in an easy to understand manner. The theories and models are illustrated using practical system examples. This tutorial would prove useful to anyone interested in gaining deeper understanding of T&D systems reliability and engaged in the business of electric energy systems, such as practicing engineers, regulators, transmission service providers, energy traders, students and academics. The materials presented in the tutorial strike a balance between basic reliability theories and their practical applications, and are presented by some of the renowned experts in the power system reliability field from academia and industry.

### **T2 - Distribution Automation (0.8 CEU) Full Day Thursday July 24<sup>th</sup>** Presented by Transmission and Distribution Committee

The concept of distribution automation dates back to the 1970's. The main motivation was to use evolving computer and communications technology to improve operating performance of distribution systems. Initially, a few small pilot projects were implemented by a few utilities to test the concept. In the 1980's, we saw several major pilot projects. By the 1990's the technology had matured and that resulted in several large and many small projects at various utilities. It was expected that most of the utilities would embark on large-scale distribution automation. However, many utilities found it difficult to justify DA based on hard cost-benefit numbers. Business uncertainties due to deregulation and restructuring of the power industry slowed implementation of DA. Now, there is renewed interest due to emergence of new technologies, specifically new measuring devices and sensors, more powerful and refined communication equipment, highly advanced computing equipment, advanced power electronics equipment, and new control and protection ideas.

### **T3 - Understanding Power Electronics in Contemporary Power Systems** (0.4 CEU) Half Day Monday July 21<sup>st</sup> Presented by PEEC Committee

The objective of this fast-paced top-down tutorial is to present: 1) the role of power electronics in contemporary power systems that integrate renewable generation (such as wind and photovoltaics), storage, reliable delivery (HVDC transmission systems and FACTS devices such as SVC/STATCOM, TCSC), and efficient end-use (variable-speed

drives and new types of lighting) [1 Hour], and 2) to describe the operation of power electronics (solid state devices, thyristor circuits, and switch-mode converters) that facilitate the required interface as well as Power Quality concerns [3 Hours]. This tutorial will be useful for the following reason: the nature of power systems has changed over the years. Many high-level managers and power engineers educated sometime ago were never exposed to these topics that are critical in contemporary power systems. Unfortunately, the current graduates are also not taught these subjects because the curriculum followed in most universities, with a few exceptions, has not changed to take contemporary practices into account. This concise tutorial is organized to present the understanding of power electronics – its role in contemporary power systems and understanding its operation. How much is derived by an attendee will depend on their background. For example, high-level managers who may have a background in another area other than EE will appreciate what can be done. Utility engineers working in their narrow specialty will understand alternative ways of doing things. And the academics in the audience will be able to potentially reform their courses to emphasize the contemporary topics.

**T4 - Power Electronics: Power Factor & Harmonics, Variable Frequency Drives, Solid-State Starters**  
(0.8 CEU) Full Day Tuesday July 22<sup>nd</sup> Presented by Electric Machines Committee

This tutorial is designed to introduce utility engineers to the world of power electronics. The sections of the seminar will cover a Power Electronics Overview, Power Factor and Harmonics, Variable Frequency Motor Drives, and Solid-State Motor Starters. Each section will discuss the theory of operation as well as the load implications for the supplying utility. The ‘Power Electronics Overview’ will cover feedback control systems, rectifiers and converters, phase control, switch mode systems, SCR characteristics, a number of power electronics applications, and the principles of utility applications such as VAR compensators and HVDC converters. ‘Variable Frequency Motor Drives’ discusses the historical development of variable frequency drives and their present use in the low and medium voltages, and covers various types of drives, their theory of operation, and their areas of application in present day drive ranges to 35,000 hp at 13.8 kV. In ‘Power Factor and Harmonics’, these two subjects come together in their effects on the supplying utility. Power electronics may inject harmonic currents and low power factors into the supply, and resonance problems can arise. The origins of harmonics, their effects, and mitigation methods will be discussed. Finally, ‘Solid-State Motor Starters’ characteristics and their areas of application will be discussed. They offer continuous control of induction motor starting currents, and can mitigate the effects of high inrush currents on the supply and reduce mechanical stresses from across the line starting.

**T5 - Wind Generator Modeling and Controls** (0.8 CEU) Full Day Tuesday July 22<sup>nd</sup>  
Presented by IEEE Task Force on Dynamic Performance of Wind Generators

Wind generation continues to advance at a rapid pace in terms of technology and installed capacity. In some areas of Europe and North America wind power plants already have a major impact on power system performance. This tutorial will provide detailed information on representation of wind power plants in large-scale power flow and dynamic stability studies, as well as short circuit. Wind power plant performance and controls will be covered in detail to frame the requirements and approaches for modeling and simulation. Topics will include overview of the wind industry, steady-state representation, dynamic representation, short circuit representation, and recent experience with interconnection studies. Existing or future interconnection standards such as LVRT, reactive power/power factor control, frequency response, etc., will be discussed to the extent that they affect modeling and simulation. Integration issues such as reserve requirements, integration cost are outside the scope of the tutorial.

**T6 -Static VAR Compensators** (0.8 CEU) Full Day Sunday July 20<sup>th</sup>  
Presented by Substation Committee

Fast control of reactive power by means of shunt-connected static devices is a proven technology. Working Group I4 on Static VAR Compensators of the High Voltage Power Electronics Stations Subcommittee has maintained a list of industrial and utility SVC’s installations around the world and found more than 500 of these installations still in service after 25 years of operation. They are still considered today as competitive solutions to meet future needs of reactive power compensation. Past tutorials offered on SVCs have focused mainly on power system aspects and on justifying the need for SVCs. This tutorial focuses on equipment design and operations. A brief review of system aspects which justifies the need for fast reactive power compensation and a description of various applications are presented. It is intended to provide participants with a solid understanding of basic components, their integration in substation design, control systems, dynamic performance, and commissioning of SVCs. This tutorial targets engineering personnel, plant and design engineers, and anyone responsible for: 1) validating the dynamic performance during the design stage, and 2) ensuring reliable operations of SVCs.

**T7 - Lightning Protection Technologies & Applications** (0.8 CEU) Full Day Wednesday July 23<sup>rd</sup>  
Presented by Surge Protective Devices

This one-day workshop is designed to help energy service professionals, and electricity users understand lightning protection principles from a practical applications perspective for power distribution systems, facilities, and sensitive electronic equipment. The workshop will provide a very broad background on the subject matter as taught by some of the noted experts in the field. Attendees will learn about the various protection technologies and applications through real world case studies as well as intermediate and advanced level technical discussions. The workshop summarizes the latest IEEE Surge Protective Devices Committee developed standards, information, methodologies, and techniques for evaluating, specifying and applying SPD's. The first half of the workshop focuses on up-to-date methods of power system protection for high voltage (HV) applications. The second half focuses on SPD's for low voltage (LV) applications. This course will help the novice understand the fundamentals and the experienced engineer better understand the details. Attendees come mainly from system design, maintenance, and planning groups with engineering backgrounds.

**T8 - Design & Application of Power Circuit Breakers (0.8 CEU) Full Day Thursday July 24<sup>th</sup>**  
Presented by Switchgear Committee

Industry Standards which govern the design, testing and application of power circuit breakers have undergone significant changes since their original publication. This natural evolution of standards follows changes in both the advancing technology of the equipment and the increasing demands imposed on them due to the complex environment in which they are applied. This never-ending process makes it critical for system design engineers and planners to be aware of the current status of, and recent changes to, these standards in order to properly specify and apply this equipment. This tutorial will begin with a historical review of the standards, describe the evolution of various rating methods used, and review the significant changes made in the current publications. This will be useful to those engineers faced with the task of specifying new circuit breakers that will be used to replace equipment that was manufactured to previous editions of the standards. A review of the most common types of circuit breaker interrupter technologies will be conducted. Transient recovery voltage (TRV) application considerations and specific switching duties will be presented. These include terminal faults, short line faults, and out-of-phase switching. Changes to the TRV envelope specifications which are in the process of being implemented in the IEEE Standards will be reviewed. Unique characteristics of switching capacitive and inductive loads are also presented. A review of the methods used to test high power circuit breakers is part of this tutorial. Considerations that are necessary for proper design and selection of equipment destined for installations in seismic areas are also covered. It is recognized that time constraints limit the scope of this tutorial to provide summary information on the topics presented. However, sufficient background and reference material will be identified to enable the attendees to probe further into each topic covered. The presenters are recognized experts in the field of circuit breaker design, ratings and applications.

**PS:** A Short Course for the Non-Power Engineering Professional is being co-located with the PES General Meeting. It is **Power System Basics** on Tuesday July 22<sup>nd</sup> presented by IEEE Power Engineering Society. It is geared toward those in non-technical positions in the power field such as: policy makers, power marketers, utility commission staff, media, public relations personnel, legal counsel, consumer groups, purchasing agents, accountants, managers, and executives. The goal is to provide an understanding of electric utility operations. Please help us market this course to those that may benefit from attending by directing them to the meeting website noted above for more details, cost, and registration information, which will be posted in the near future. Registration for the General Meeting is NOT required.

**Contact:** Bob Slobodnik with any questions on these tutorials at: [rslebod@alleghenypower.com](mailto:rslebod@alleghenypower.com)

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### **Registration Form for Expanded Tutorial Offering**

To sign up for any of the above tutorials, except Power System Basics, fill out this Registration Form. Send it to the address listed below along with check made payable to "IEEE Pittsburgh Section". Class size is limited by the meeting rooms available, so register early to ensure your participation. Note: All registration fees noted below will go by \$25 up after June 24<sup>th</sup>.

Name (if you are a PE, as it appears on your License): \_\_\_\_\_

PE State & License Number (if applicable): \_\_\_\_\_

Phone Number: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Company: \_\_\_\_\_

_____ T1 – Probabilistic T & D System Reliability Planning	\$ 225
_____ T2 – Distribution Automation	\$ 225
_____ T3 – Understanding Power Electronics in Contemporary Power Systems	\$ 175
_____ T4 – Power Electronics: Power Factor & Harmonics, VF Motors & Drives	\$ 225
_____ T5 – Wind Generator Modeling and Controls	\$ 225
_____ T6 – Static VAR Compensators	\$ 225
_____ T7 – Lightning Protection Technologies and Applications	\$ 225
_____ T8 – Design & Application of Power Circuit Breakers	\$ 225

Total \$ \_\_\_\_\_

Mail this form and check to:  
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