Registration Form

Northeastern University Center for Energy Education and Research
Department of Electrical and Computer Engineering
Tel: 617.373.4159 • Fax: 617.373.4431 • E-mail: lbonda@ece.neu.edu

Name _____
(Last) (First/Middle)

Organization _____

Job Title _____

Mailing Address _____

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Registration Fee**

One Person	$ 1000.00	
CEU Processing Fee	$ 30.00	TOTAL $_____

*** Discounts available for NUCEER members. Inquire about discounts and membership.*

Cancellation Policy

Guaranteed registration deadline is June 1st. After June 1st, registration is on a first-come-first served basis only. Registration fees will be refunded less a cancellation fee of $100, if written cancellation request is received on or before June 1st. Northeastern University reserves the right to cancel the course, if necessary, due to low registration before June 1st and will provide full refund of paid registration fees.

Payment

☐ Company Check (U.S. Dollars) *Please make check payable to Northeastern University.*
Credit Card: ☐ Mastercard ☐ Visa ☐ AmEx ☐ Discover

Card # _____ Exp. Date _____

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☐ I authorize Northeastern University to charge the above credit card for the amount of $_____.

Today's Date _____

☐ Continuing Education Units (CEU) are available upon request by checking this box. Completing the course will earn 1.7 CEUs.

Mail this registration form with payment to:

NUCEER Short Courses
Att: Linda Bonda
Department of Electrical and Computer Engineering
409 Dana Research Center
Northeastern University
360 Huntington Avenue
Boston, MA 02115-5000

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NORTHEASTERN UNIVERSITY CENTER for ENERGY EDUCATION AND RESEARCH (NUCEER)

A Short Course on:

Modeling and Signal Processing Methods for Electrical Transients and Power Quality

June 10-12, 2009

Northeastern University
Electrical & Computer Engineering

Introduction

This is a two part course. The first part covers the basics of Modeling and Simulation of Electrical Transients. The second part is about basics of Signal Processing applied to Power Quality and Phasor Measurements.

The course provides sufficient details on the use of Alternative Transients Program (ATP) so that even a new user can start using the software after taking the course. Reliability and power quality concepts behind the formulation of various indices and their practical implications in designing reliable power systems will be discussed. Signal processing fundamentals that constitute the techniques used in frequency and phasor measurements will be covered. Computer exercises will be used to illustrate the concepts and allow the attendees to interact with the course instructors during the hands on parts of the course.

Who Should Attend

Engineers responsible for fault analysis and power system transients

Engineers responsible for system planning

Engineers responsible for metering and instrumentation

Engineering consultants

Advanced graduate students

Expected Benefits

Capability to use the Alternative Transients Program to model and simulate power system transients

Understanding the fundamentals of power quality issues and remedies

Become familiar with the terminology and notation used in power system transients and three phase network models

Interpretation of ATP output for various different types of transient studies

Understanding the fundamentals of signal processing methods that are used in frequency and phasor measurements

411283

Instructors

Ali Abur, professor and chair of Electrical and Computer Engineering Department at Northeastern University, Boston, MA. His research and educational activities have been in the area of power systems. He is a Fellow of the IEEE for his work on power system state estimation. He is the co-author of the book "Power System State Estimation" and published widely in IEEE journals and conferences. He serves on the Editorial Board of IEEE Transactions on Power Systems and Power Engineering Letters.

Alex Stankovic, distinguished professor of Electrical and Computer Engineering Department at Northeastern University, Boston, MA. He is a Fellow of the IEEE and serves on the Editorial Board of IEEE Transactions on Power Systems, Power Engineering Letters and Circuits and Systems Magazine. He is a co-editor of the book series on Power Systems and Power Electronics for Springer.

Hanoch Lev-Ari, professor of Electrical and Computer Engineering Department at Northeastern University, Boston, MA, and past director of the Center for Communications and Digital Signal Processing at this university. He is a Fellow of the IEEE and a member of SIAM. He served as an associate editor of Circuits, Systems and Signal Processing, and of the IEEE Transactions on Circuits & Systems I.

Campus Information

Classes will be held in The Snell Engineering Building, Room 268, from 9 am-5 pm. Registration fee includes course notes, supplies, and lunch at the University's Faculty Club at the Alumni Center.

Northeastern University is located on Huntington Avenue in Boston. Driving and parking information is available via the University's main website at http://www.northeastern.edu/campusmap. For students driving and parking on campus, parking coupons will be provided.

Hotel information is available at:
http://www.northeastern.edu/admissions/visitcampus/explore.html#stay
Several hotels offer a special rate to Northeastern; call for that information.

Course Outline

Wednesday, June 10

Course Objectives and Outline
- Introduction to transient simulations
- Guidelines and simulation methods

Simulation Programs
- Electromagnetic transient programs
- Data requirements
- Input interface
- Output processing

Transmission Line Modeling
- Transmission line parameter calculations
- Traveling waves
- Multi-phase models, modal analysis
- Discrete time models for transients simulation
- Distributed, constant parameter models
- Frequency dependent models
- Source models and network equivalencing

Transformer Modeling
- Nonlinear elements: data requirements
- Multi-phase, multi winding transformer models
- Saturation and inrush
- Instrument transformers: CTs & CCVTs

Computer Exercises
- Simple switching transients
- Simulation of faults: effects of fault resistance, type, inception angle, location
- Long and short lines
- Mutually coupled lines
- Series capacitors and MOVs
- Network equivalents

Thursday, June 11

An overview of Power Quality Issues

An overview of Probability
- Basic calculations
- Random variables
- Limit theorems
- Normal (Gaussian) random variable

A review of power quality standards
- IEC 61000 series
- IEE 519
- CBEMA/ ITI curves

Fundamentals of Power System Reliability
- Basic reliability evaluation techniques
- A review of the Poisson process
- Markov models

Power Assessment
- Apparent and Reactive Power in General Polyphase Networks

Computer Exercises

Friday, June 12

Waveform Processing Techniques

Fourier series for periodic waveforms
- Complex and real Fourier coefficients, phasors
- Parseval identity and duality
- Effects of measurement noise and other inaccuracies

Fourier transform for transient waveforms
- Properties
- Duality and Parseval identity
- Periodic signals

Sampling of bandlimited waveforms
- Sampling and reconstruction
- Frequency domain perspective
- Nyquist criterion and the sampling theorem
- Fourier analysis from waveform samples: the DTFT

Phasor computation via DFT/FFT
- Periodic waveforms and FFT
- Effects of measurement noise and leakage
- DFT for transient waveforms – zero padding and resolution

Phasor Measurement Units (PMU)
- Block diagram description
- The synchrophasor standard
- Applications

Dynamic phasors
- Sliding window DFT and filter bank interpretation
- Fractional dynamic phasors – curve fitting
- Types of transients and their phasor signatures