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Your International Source for
Electrical Power Training

Power System Analysis
Per Unit and Symmetrical Components
2 Days - 1.6 CEUs

This is the most complex of all of Jim's classes. Per Unit and Symmetrical Component Analysis is a fundamental part of power system analysis. Unfortunately, these important subjects are not always covered in the college curriculum. Jim bases this class on his power system analysis background and takes the magic and mystery out of Symmetrical Components and Per Unit with his simplified and straight forward approach. Whether you are just learning these concepts or are preparing for the P.E. exam, this course is a must for all that want a better understanding of power system analysis. The most frequently heard comment by students is "I wish I had this class BEFORE I took the P.E. exam the first time."

What you *WILL* receive:

- Training manuals containing almost 200 pages
- Jim's per unit calculation worksheets
- An understanding of symmetrical components
- Simplified modeling methods
- Many calculation examples and problems
- 16 hours of Continuing Education Credit

What you ***WILL NOT*** receive:

- A commercial to sell you products or equipment
- A sales pitch to sell engineering study services
- A class that is just an overview or teaser

What is so special about Jim Phillips' Power System Class?

Jim is not only one of the most popular and sought after instructors in the industry, he is also directly involved with the development of industry standards and practices. He is a member of the IEEE working group that develops *IEEE Std. 1584 [tm], IEEE Guide for Performing Arc Flash Hazard Calculations*. With a career spanning 30 years and having taught over 2000 training programs to people from all seven continents, Jim draws from his vast experience in the industrial, commercial and utility fields.

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Course Agenda
Power System Analysis

DAY ONE – Per Unit Analysis

POWER SYSTEM ANALYSIS CONCEPTS
RLC Circuits, Series, Parallel, Delta/Wye, Complex Impedances, Per Phase Analysis, Thevenin Equivalents

PER UNIT ANALYSIS
Base Quantities, Per Unit Voltage Current and Impedance, Selecting the Appropriate Base, Changing Bases, Per Unit Problem Solving Worksheets, Per Unit Examples

IMPEDANCE DIAGRAMS
Developing the Per Unit Impedance Diagram, Labeling the Diagram, Solving Per Unit Load Problems with the Diagram, Per Unit Short Circuit Problems

METERING
Ammeter, Voltmeter, Wattmeter, Varmeter, CTs and PTs

TRANSFORMERS
Transformer Turns Ratio, Analysis, Efficiency, Impedances, Transformer Model, Modeling Core and Winding Losses

ROTATING MACHINES
Induction Machines Modeling, Induction Machine Circuit Analysis, Stator and Rotor Impedances, Slip and Motor Speed, Calculating FLA, LRA and PF. Solving Machine Problems

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Course Agenda
Power System Analysis

DAY TWO – Symmetrical Components

CONDUCTOR MODELING
Impedance Data, Geometric Mean Radius, Geometric Mean Distance, Capacitive Line Charging, Skin Effect

TRANSMISSION LINES
Short, Medium and Long Transmission Line Models, Voltage Drop, Sending End and Receiving End Voltage, Conductor Data a.k.a. “The Birds” Wax Wing, Blue Jay, Partridge etc.

MOTOR STARTING
Using the Per Unit System to Solve Motor Starting Problems, Voltage Flicker Analysis

SYMMETRICAL COMPONENTS
Positive, Negative and Zero Sequence, Zero Sequence Diagrams, Effect of Grounding on Zero Sequence Impedance, Solving Symmetrical Component Problems Painlessly! Transmission Line Problem and Examples, Solving Three Phase and Line-to-Ground Short Circuit Problems with Positive, Negative and Zero Sequence Impedances.

SHORT CIRCUIT CALCULATIONS
Ohmic and Per Unit Calculations, Symmetrical Component Calculations for Balanced and Unbalanced Faults

POWER FACTOR BASICS
Vars, Watts, VA and Power Factor, Sizing the Capacitor, Harmonic Concerns

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On Site Training
Have This Course at Your Location!
Hold this class at your location for a greater savings. For an all inclusive fee you receive the following for each attendee:

What you *WILL* receive:

- Training manuals containing almost 200 pages
- Jim's current transformer saturation worksheets
- Jim's differential relaying worksheets
- Technical articles
- Many calculation examples and problems
- 16 hours of Continuing Education Credit

Call Brenda at 800-874-8883 or e-mail at: brenda@brainfiller.com for an On-Site Training Proposal!

Plan Ahead - Jim's schedule usually fills up months in advance!

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Jim Phillips, P.E.

Member of IEEE 1584 *IEEE Guide for Performing Arc Flash Hazard Calculations*

Vice - Chairman of Task Group - *IEEE 1584.1 Guide for the specification of scope and deliverable requirements for an arc-flash hazard calculation.*

Member of IEC 61482-1-2 Determination of arc protection class of material and clothing by using a constrained and directed arc (box test)

Author of the book: *Complete Guide to Arc Flash Hazard Calculation Studies*

Is a regular contributor to Electrical Contractor

Founder of the internationally known website: www.ArcFlashForum.com

For 30 years, Jim has been helping tens of thousands of people around the world understand electrical power systems design, safety, theory and applications. Having taught over 2000 seminars during his career to people from all seven continents (Yes Antarctica is included!), he has developed a reputation for being one of the best trainers and public speakers in the industry.

Jim does not just talk about arc flash and electrical safety - he is part of the development of the arc flash standards! He is also the instructor that has taught other instructors in the industry. Jim is a member of the IEEE 1584 Committee - *IEEE Guide for Performing Arc Flash Hazard Calculations.* He is Vice-Chairman of the IEEE Task Group - IEEE 1584.1 "Guide for the specification of scope and deliverable requirements for an arc-flash hazard calculation study in accordance with IEEE 1584"

Jim literally wrote the book about arc flash studies with his book titled: ***Complete Guide to Arc Flash Hazard Calculation Studies*** available from brainfiller.com and Amazon.com He also wrote "How to Perform an Arc Flash Study in 12 Steps" published by NFPA.

In addition to being a regular contributor to Electrical Contractor Magazine, he was one of the main contributors for the NEC Digest. He has authored many articles published in Europe and is a regular speaker at conferences around the world.

Jim earned a BS Degree in Electrical Engineering from the Ohio State University. His career began with Square D Company's Power System Analysis Group where he was responsible for system studies, power system software development and training at their engineering programs.

Later, Jim was in charge of the studies group of the System Protection Section of Ohio Edison Company. He was part of the adjunct faculty for Stark State College where he taught evening classes in electrical power systems.

Jim is a Registered Professional Engineer. with experience that includes everything from planning transmission systems, to design and analysis of industrial, commercial and utility power systems, cogeneration plant design, expert witness and forensic analysis.

Jim continues to travel the globe typically flying over 150,000 miles a year to work with various U.S. and international standards organizations and speak at many conferences and training events.