

COURSE OVERVIEW EE1175
Oscillatory Stability & Power System Stability (PSS) Tuning

Course Title

Oscillatory Stability & Power System Stability (PSS) Tuning

Course Date/Venue

October 19-23, 2026/Al Danah Suite, Le Royal Méridien Abu Dhabi, Abu Dhabi, UAE

Course Reference

EE1175

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs



Course Description



This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.



This course is designed to provide participants with a detailed and up-to-date overview of Oscillatory Stability & Power System Stability (PSS) Tuning. It covers the power system stability, basics of synchronous machine dynamics and types of oscillations in power systems; the small-signal stability analysis, damping in power systems and power system stabilizers (PSS); the generator and excitation system modeling and state-space modeling of power systems; the eigenvalue analysis, frequency domain analysis, time-domain simulation and measurement of oscillations; the PSS structure and components and PSS design objectives; and the classical PSS design methods.



During this interactive course, participants will learn the multi-machine system considerations, PSS types and configurations and limitations of conventional PSS; the optimization-based PSS tuning and robust control approaches and adaptive and intelligent PSS; the wide-area damping control (WADC), interaction with other controllers and practical tuning considerations; the on-site testing procedures and signal validation; and the performance verification and troubleshooting issues.

Course Objectives/Outcomes & Benefits for the Participants

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on oscillatory stability and power system stability (PSS) tuning
- Discuss power system stability, basics of synchronous machine dynamics and types of oscillations in power systems
- Carryout small-signal stability analysis, damping in power systems and power system stabilizers (PSS)
- Recognize generator and excitation system modeling and state-space modeling of power systems
- Apply eigenvalue analysis, frequency domain analysis, time-domain simulation and measurement of oscillations
- Explain PSS structure and components, PSS design objectives and classical PSS design methods
- Discuss multi-machine system considerations, PSS types and configurations and limitations of conventional PSS
- Interpret optimization-based PSS tuning and discuss robust control approaches and adaptive and intelligent PSS
- Recognize wide-area damping control (WADC), interaction with other controllers and practical tuning considerations
- Apply on-site testing procedures, signal validation, performance verification and troubleshooting issues

Exclusive Smart Training Kit - H-STK®



Participants of this course will receive the exclusive “Haward Smart Training Kit” (H-STK®). The H-STK® consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.

Who Should Attend

This course provides an overview of all significant aspects and considerations of oscillatory stability and power system stability (PSS) tuning for power system and electrical engineers, grid stability and control engineers, power plant and utility engineers, protection and control engineers, generator and excitation system engineers, transmission system operators and control center personnel, commissioning and testing engineers, power system planning and reliability specialists, operations and maintenance engineers in generation facilities, professionals involved in oscillation analysis, small-signal stability and power system stabilizer (PSS) tuning.

Course Fee


US\$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours

Certificate Accreditations

Haward's certificates are accredited by the following international accreditation organizations:

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British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

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The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



Dr. Ahmed El-Sayed, PhD, MSc, BSc, is a Senior Electrical & Instrumentation Engineer with over 30 years of extensive experience in the Oil, Gas, Power, Petroleum, Petrochemical and Water & Utilities. He specializes in Fire Fighting System Instrumentations, Fire Protection System, Fire & Gas Detection & Alarm System, Instrumentation Protection Devices Maintenance & Testing, Protection Devices Troubleshooting, Water Meter Calibration, Liquid & Gas Flowmetering & Meter Calibration, Testing & Calibration of Energy Meters, DCS & ESD System Architecture, Distributed Control System, DCS & SCADA, Distributed Control System (DCS) Selection & Troubleshooting, Advanced DCS Yokogawa, Yokogawa CENTUM VP DCS,

Modern Distributed Control System (DCS) & Process Instrumentation, Cyber Security of Industrial System, DCS System (Honeywell), DCS Experion System, DCS Siemens Teleperm XP, Relay Coordination Using ETAP Software, Power System Study on ETAP, ETAP-Power System Analysis, Flow Measurement Foundation, Hydrocarbon Measurement & Sampling, Gas Dosiers Preparation, Gas/Liquid Fuel Measurement, Instrumentation Measurement & Control System, Flow Measurement, Pressure Measurement, Level & Temperature Measurement, Measurement Devices & Control System, Instrumentation & Control Systems, Control System Orientation, Uninterruptible Power Supply (UPS) Battery Charger, Industrial UPS Systems Construction & Operation, Test Lead-Acid & Ni-cad Battery Systems, Hazards & Safe Work Practices, Transformer Operational Principles, Selection & Troubleshooting; HV & LV Transformers, Control Valves & Actuators, Electrical Safety, Protection Relay Application, Maintenance & Testing, NEC (National Electrical Code), NESC (National Electrical Safety Code), Electrical Safety, Electrical Hazards Assessment, Electrical Equipment, Personal Protective Equipment, Lock-Out & Tag-Out (LOTO), Confined Workspaces, Alerting Techniques, Electrical Transient Analysis Program (ETAP), Power Quality, Power Network, Power Distribution, Distribution Systems, Power Systems Control, Power Systems Security, Power Electronics, Electrical Substations, UPS & Battery System, Earthing & Grounding, Load Forecasting, Power Generation, Protective Systems, Electrical Generators, Power & Distribution Transformers, Electrical Motors, Switchgears, Transformers, AC & DC Drives, Variable Speed Drives & Generators, Generator Protection, GE Gas Turbines, PLC, SCADA, DCS, Process Control, Control Systems & Data Communications, Instrumentation, Automation, Valve Tuning, SIS, SIL, ESD, Alarm Management Systems, Energy Management System, Engine Management System, Bearing & Rotating Machine, Fieldbus Systems and Fiber Optics Technology. He is currently the **Systems Control Manager of Siemens where he is in-charge of Security & Control of **Power Transmission Distribution & High Voltage Systems** and he further takes part in the Load Records Evaluation & Transmission Services Pricing.**

During his career life, Dr. Ahmed has been actively involved in different Power System Activities including Roles in Power System Planning, Analysis, Engineering, **HV Substation Design**, Electrical Service Pricing, Evaluations & Tariffs, Project Management, Teaching and Consulting. His vast industrial experience was honed greatly when he joined many International and National Companies such as **Siemens, Electricity Authority and ACETO** industries as the **Instrumentation & Electrical Service Project Manager, Instrumentation & Control Engineer, Fire Protection Engineer, Energy Management Engineer, Department Head, Assistant Professor, Instrumentation & Control Instructor, Project Coordinator, Project Assistant and Managing Board Member** where he focused more on dealing with Technology Transfer, System Integration Process and Improving Localization. He was further greatly involved in manufacturing some of **Power System and Control & Instrumentation Components** such as Series of Digital Protection **Relays, MV VFD, PLC and SCADA System** with intelligent features.

Dr. Ahmed is well-versed in different electrical and instrumentation fields like **ETAP**, Load Management Concepts, **PLC Programming**, Installation, Operation and Troubleshooting, **AC Drives Theory**, Application and Troubleshooting, Industrial Power Systems Analysis, AC & DC **Motors**, Electric Motor **Protection, DCS SCADA, Control** and Maintenance Techniques, Industrial Intelligent Control System, **Power Quality Standards**, Power Generators and Voltage Regulators, Circuit Breaker and Switchgear Application and Testing Techniques, **Transformer and Switchgear Application**, Grounding for Industrial and Commercial Assets, Power Quality and **Harmonics, Protective Relays** (O/C Protection, Line Differential, Bus Bar Protection and **Breaker Failure Relay**) and Project Management Basics (PMB).

Dr. Ahmed has **PhD, Master's & Bachelor's** degree in **Electrical Engineering** from the **University of Wisconsin Madison, USA** and **Ain Shams University**, respectively. Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/ Assessor/Trainer** by the **Institute of Leadership and Management (ILM)**, an active member of **IEEE and ISA** as well as numerous technical and scientific papers published internationally in the areas of Power Quality, Superconductive Magnetic Energy Storage, SMES role in Power Systems, Power System **Blackout Analysis**, and Intelligent Load Shedding Techniques for preventing Power System Blackouts, **HV Substation Automation** and Power System Stability.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures
- 20% Practical Workshops & Work Presentations
- 30% Hands-on Practical Exercises & Case Studies
- 20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1: Monday, 19th of October 2026

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Introduction to Power System Stability Definition and Classification of Stability • Rotor Angle, Voltage, and Frequency Stability • Importance in Modern Grids • Historical Blackout Examples
0930 – 0945	Break
0945 – 1030	Basics of Synchronous Machine Dynamics Swing Equation and Rotor Dynamics • Inertia and Damping Concepts • Mechanical versus Electrical Torque • Small-Signal versus Transient Behavior
1030 – 1130	Types of Oscillations in Power Systems Local Modes (Intra-Plant Oscillations) • Inter-Area Oscillations • Control Mode Oscillations • Forced Oscillations
1130 – 1215	Small-Signal Stability Analysis Linearization of System Equations • State-Space Representation • Eigenvalues and System Modes • Stability Criteria
1215 – 1230	Break
1230 – 1330	Damping in Power Systems Natural Damping Sources • Negative Damping Effects • Role of Excitation Systems • Need for Supplementary Control
1330 – 1420	Basics of Power System Stabilizers (PSS) Purpose and Function of PSS • Basic Operating Principle • Signals Used for Stabilization • Overview of PSS Types
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day One

Day 2: Tuesday, 20th of October 2026

0730 – 0830	Generator & Excitation System Modeling Synchronous Machine Models (Classical to Detailed) • AVR (Automatic Voltage Regulator) Models • Impact of Excitation on Stability • Modeling Simplifications
0830 – 0930	State-Space Modeling of Power Systems Formulating State Variables • Linear System Representation • Matrix Formulation (A, B, C, D) • Interpretation of System Modes
0930 – 0945	Break
0945 – 1100	Eigenvalue Analysis Real and Imaginary Parts of Eigenvalues • Damping Ratio and Frequency • Mode Shapes and Participation Factors • Identifying Critical Modes
1100 – 1215	Frequency Domain Analysis Transfer Functions • Bode Plots • Gain and Phase Margins • Stability Assessment
1215 – 1230	Break
1230 – 1330	Time-Domain Simulation Transient Response Analysis • Disturbance Scenarios • Oscillation Observation • Validation of Models
1330 – 1420	Measurement of Oscillations PMU (Phasor Measurement Units) Basics • Wide Area Measurement Systems (WAMS) • Signal Processing Techniques • Real-Time Oscillation Detection
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two

Day 3: Wednesday, 21st of October 2026

0730 – 0830	PSS Structure & Components Washout Filters • Lead-Lag Compensators • Gain Blocks • Input Signal Selection (Speed, Power, Frequency)
0830 – 0930	PSS Design Objectives Improving Damping Ratios • Enhancing System Stability Margins • Avoiding Adverse Interactions • Robust Performance
0930 – 0945	Break
0945 – 1100	Classical PSS Design Methods Phase Compensation Approach • Root Locus Method • Frequency Response Method • Parameter Selection
1100 – 1215	Multi-Machine System Considerations Interaction Between Generators • Coordinated Tuning • Mode Observability • Decentralized versus Centralized Control
1215 – 1230	Break
1230 – 1330	PSS Types & Configurations Conventional PSS (CPSS) • Dual-Input PSS • Multi-Band PSS • Adaptive PSS

1330 – 1420	Limitations of Conventional PSS Sensitivity to Operating Conditions • Nonlinear System Effects • Limited Robustness • Need for Advanced Techniques
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Three

Day 4: Thursday, 22nd of October 2026

0730 – 0830	Optimization-Based PSS Tuning Objective Functions (Damping Ratio, Eigenvalues) • Optimization Techniques (GA, PSO) • Parameter Tuning Strategies • Performance Evaluation
0830 – 0930	Robust Control Approaches H-Infinity Control • Robust Stability Concepts • Handling Uncertainties • Controller Design Methods
0930 – 0945	Break
0945 – 1100	Adaptive & Intelligent PSS Adaptive Control Techniques • Fuzzy Logic Controllers • Neural Network-Based PSS • Real-Time Tuning Approaches
1100 – 1215	Wide-Area Damping Control (WADC) Concept of Wide-Area Control • Use of PMU Signals • Communication Delays • Control Coordination
1215 – 1230	Break
1230 – 1330	Interaction with Other Controllers AVR and Governor Interactions • FACTS Devices (SVC, STATCOM) • HVDC Links • Coordinated Control Strategies
1330 – 1420	Practical Tuning Considerations Site-Specific Tuning • Data Requirements • Testing and Validation • Field Implementation Challenges
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Four

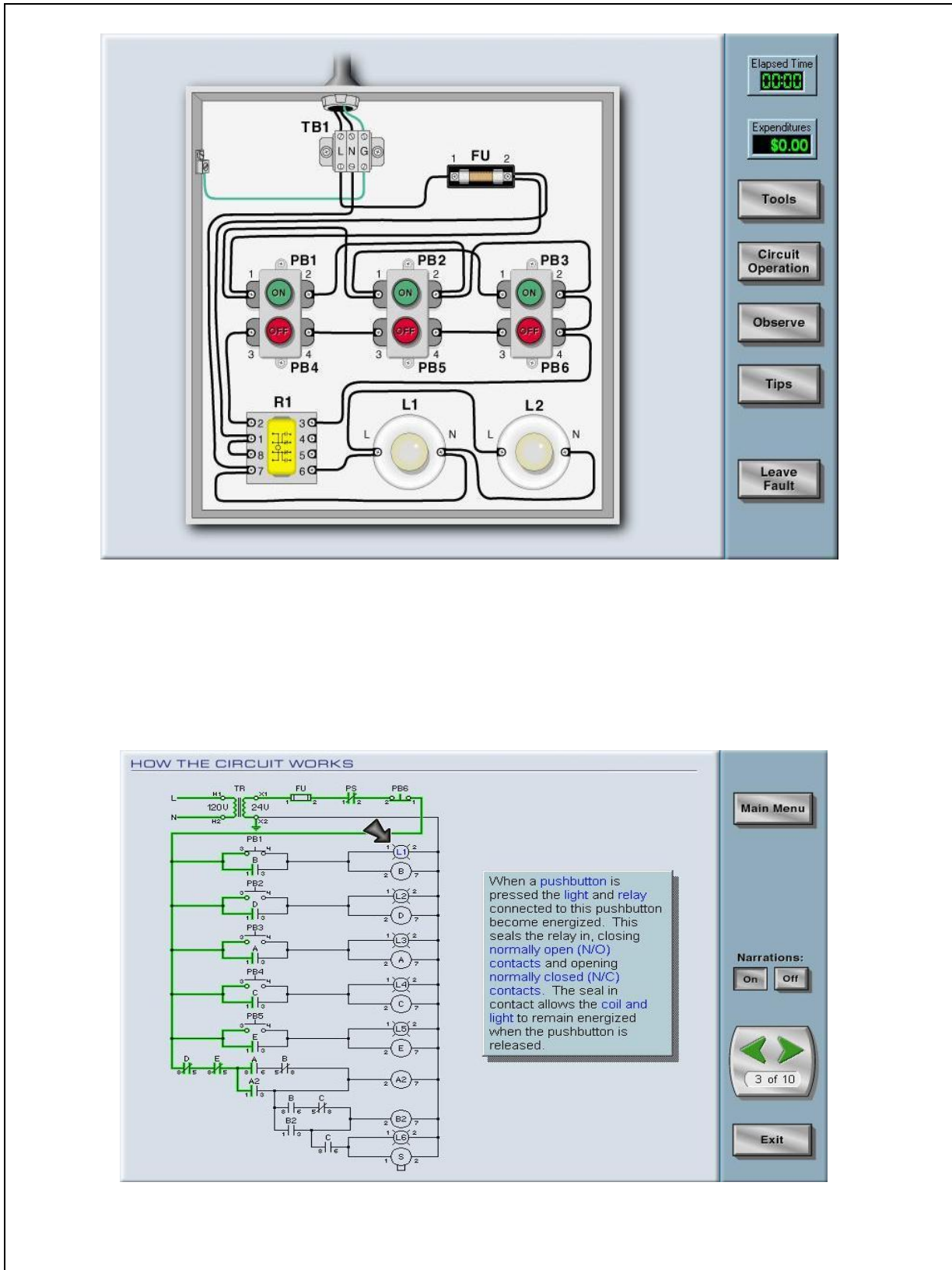
Day 5: Friday, 23rd of October 2026

0730 – 0830	Software Tools for Stability Analysis MATLAB/Simulink • DIgSILENT PowerFactory • PSS/E • Model Setup and Simulation
0830 – 0930	Case Studies of Oscillatory Instability Inter-Area Oscillation Events • Poor Damping Scenarios • Root Cause Analysis • Lessons Learned
0930 – 0945	Break
0945 – 1100	PSS Tuning Case Studies Single-Machine Infinite Bus System • Multi-Machine System Tuning • Comparison of Methods • Performance Improvements
1100 – 1215	Field Testing & Commissioning On-Site Testing Procedures • Signal Validation • Performance Verification • Troubleshooting Issues

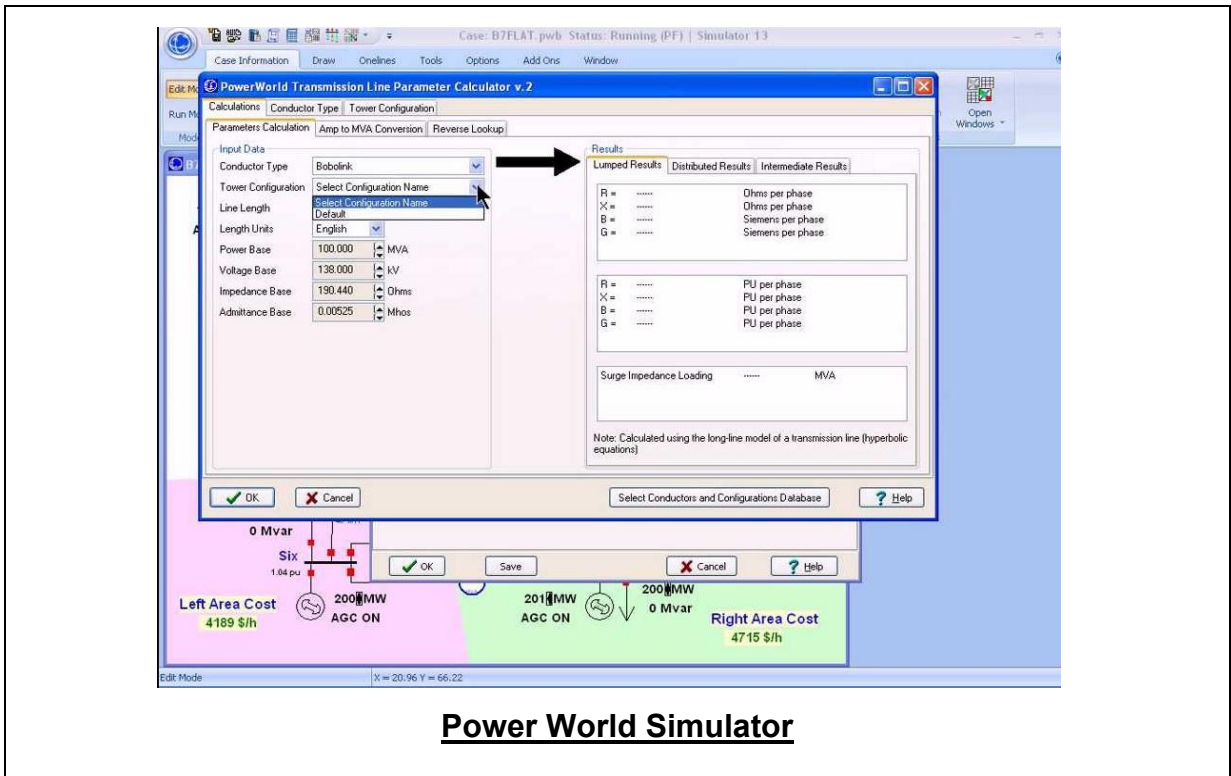
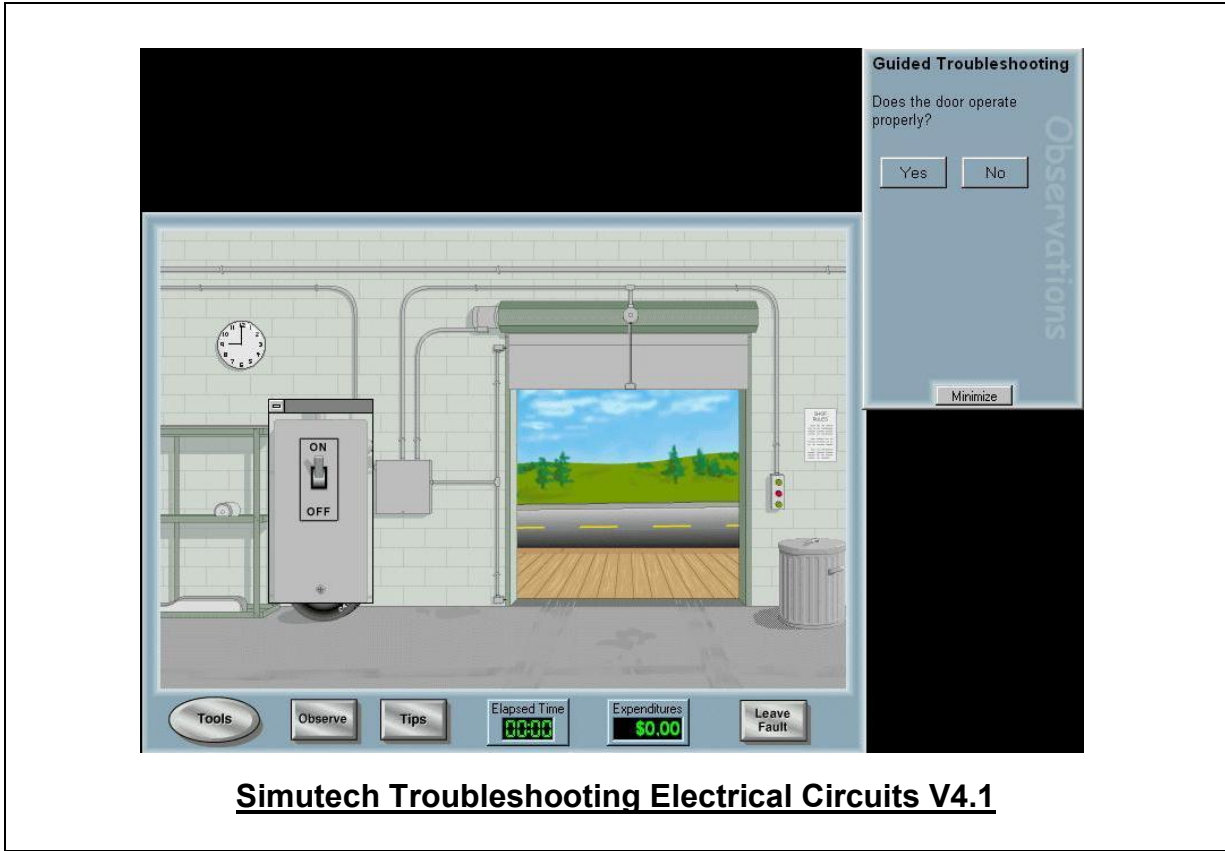
1215 – 1230	Break
1230 – 1300	Future Trends in Stability Control <i>Grid with High Renewable Penetration • Reduced System Inertia • AI-Based Stability Control • Digital Twin Applications</i>
1300 - 1345	Capstone Project & Evaluation <i>Modeling a Power System • Identifying Oscillatory Modes • Designing and Tuning PSS • Presenting Results and Recommendations</i>
1345– 1400	Course Conclusion <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course</i>
1400 – 1415	POST-TEST
1415 – 1430	<i>Presentation of Course Certificates</i>
1430	<i>Lunch & End of Course</i>

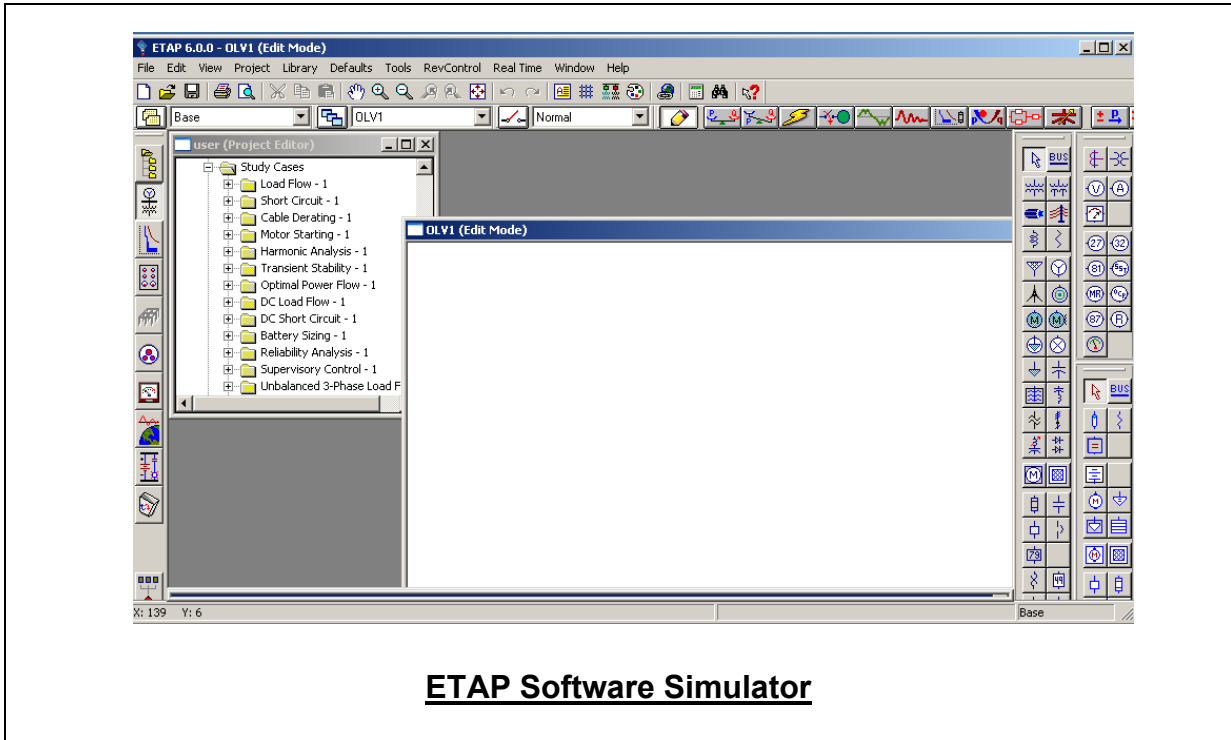
Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulator “Simutech Troubleshooting Electrical Circuits V4.1”, “Power World”, “ETAP software” and “MATLAB Simulator”.

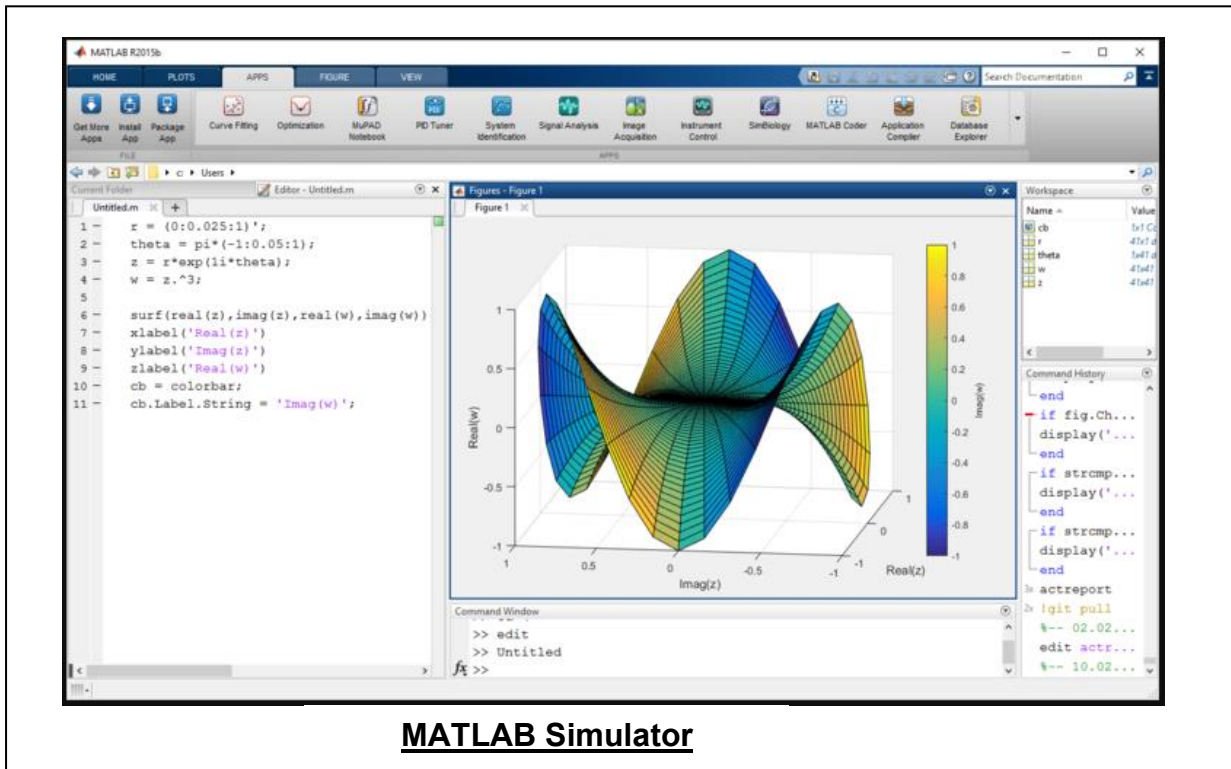


The simulator interface is divided into two main sections. The top section displays a physical circuit board with components including a terminal block (TB1), a fuse (FU), three pushbuttons (PB1-PB3), three more pushbuttons (PB4-PB6), a relay (R1), and two lamps (L1, L2). The bottom section, titled "HOW THE CIRCUIT WORKS", shows a detailed schematic diagram of the circuit. A text box explains: "When a pushbutton is pressed the light and relay connected to this pushbutton become energized. This seals the relay in, closing normally open (N/O) contacts and opening normally closed (N/C) contacts. The seal in contact allows the coil and light to remain energized when the pushbutton is released." The interface also includes a control panel on the right with buttons for "Tools", "Circuit Operation", "Observe", "Tips", "Leave Fault", "Main Menu", "Narrations: On Off", and "Exit".





ETAP Software Simulator



MATLAB Simulator

Course Coordinator

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