POWERFACTORY

Power System Stability

Course Content

Digsilent Buyisa (Pty) Ltd

POWER SYSTEM SOLUTIONS
MADE IN GERMANY

Power System Stability

3 Day Course

Objective:
The objective of the course is to provide a comprehensive overview about power system stability and control problems combined with an introduction to the dynamic modelling and simulation environment of DIgSILENT PowerFactory.

Single-machine and Multi-machine power systems are studied, using steady state, time-domain, and frequency-domain techniques. This two-day course provides a comprehensive overview about the dynamic models of elements and all the stability types:

- Transient Stability
- Oscillatory Stability
- Voltage Stability
- Frequency Stability

Each topic above includes a theoretical background and a practical part where participants acquire hands-on experience in the use of PowerFactory.

Pre-requisites:
- **MUST have attended the PowerFactory Basic course.**
- **HIGHLY recommended to have attended the PowerFactory Time Domain Simulation course.**
- A good working knowledge of the basic techniques used in PowerFactory.

No of participants:
In-house at Customer premises: Minimum: 6; Maximum: 12.
At Digsilent Buyisa Training Centre: Minimum: 6; Maximum 16.
Online: Minimum 6; Maximum x16.

ECSA CPD Accredited and Points:
- The course is fully accredited with the Engineering Council of South Africa (ECSA).
- 3 CPD points for completion.

DIGSILENT BUYISA

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Email: info@digsilent.co.za
URL: https://www.digsilent.co.za

Who Should Attend:
The course is intended for;

- Utility engineers
- Power system operators
- Project Developers
- Manufacturers
- Consultants and electrical engineers

PRICE PER PARTICIPANT:

- For course pricing, kindly visit our website at: https://digsilent.co.za/training-courses/
- For in house prices @ customer premises: contact Digsilent for a quote via email training@digsilent.co.za or Telephonically (+27) 087 351 6159.

  - ❖ Prices are exclusive of VAT.
  - ❖ Please note that cost excludes your Company's internal administrative costs.
  - ❖ All prices may change without prior notice - please contact Digsilent Buyisa for the latest prices before booking.
  - ❖ **DISCOUNT** is offered if a company sends more than one delegate per course.
  - ❖ Trainings held at Digsilent Buyisa Training Centre includes light breakfast snack, lunch, and refreshments.

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Training content

DAY 1	
	MODULE 1: Introduction to Power System Stability **Presentation: Introduction and Basic Concepts** Fundamentals of power system stability. Classification according to IEEE: rotor angle, voltage, and frequency stability. Synchronous machine and external grid model.
	MODULE 2: Transient Stability Analysis **Presentation: Rotor Angle Stability - Transient Stability** Fundamentals of transient stability. Equal Area Criterion. Factors influencing transient stability. Methods for improving transient stability problems.
	Exercise: Transient Stability in a SMIB Studies in a Single-Machine-Infinite-Bus. Critical clearing time calculation. Visualisation and analysis of results. Effect of changing the initial point of operation.
	Exercise: Transient Stability in a Multi-Machine Network Critical clearing time calculation using a DPL script. Effect of the inertia and the impedance of the system on the transient stability problems. Calculation of static and dynamic transfer limits.
	MODULE 3: Oscillatory Stability (Small Signal) Analysis **Presentation: Rotor Angle Stability - Oscillatory Stability** Description of the linearisation methods. Synchronizing and damping torques. Types of oscillatory modes. Oscillatory stability in time and frequency domain analysis. Modal analysis and eigenvalue plot. Methods to improve small signal stability.
	End of first Day

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DAY 2	
	MODULE 3: (Continued)
	Exercise: Oscillatory Stability in a SMIB Time domain analysis: Identification of the local mode of a single machine connected to an infinite bus. Local oscillation mode analysis using modal analysis – eigenvalues. Effect of controllers (AVR and PSS) on local mode of oscillation.
	Exercise: Oscillatory Stability in a Multi-Machine Network Practical example: Identification of critical oscillation modes in a multi-machine network using modal analysis. Evaluation of the type of oscillation (local, inter-area, etc) - Eigenvalues, eigenvectors, polar plots, bar plot, controllability, observability, and participation factors. Methods to efficiently increase the damping. Impact of different network configurations on the oscillation modes. Effect of Power System Stabilizers.
	MODULE 4: Voltage Stability Analysis **Presentation: Voltage Stability** Fundamentals. Classification of the voltage stability problem. Causes and contributing factors in voltage stability problems. Tools used in steady state voltage stability studies – PV curves and QV curves. Dynamic voltage stability – dynamic motor load behaviour.
	End of the second day

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DAY 3	
	MODULE 4: (Continued)
	Exercise: Steady State Voltage Stability. Part 1 Calculation of busbars sensitivities. PV curves considering contingencies. Effect of tap changers, load modelling. Effect of replacing conventional generation by renewable generation and adding a HVDC link.
	Exercise: Steady State Voltage Stability. Part 2 QV curves considering contingencies, Effect of modifying the load.
	Exercise: Dynamic Voltage Stability. Dynamic effect of replacing conventional generation and including HVDC. Motor loads and voltage recovery following a disturbance. Effect of reactive power limitations.
	MODULE 5: Frequency Stability Analysis **Presentation: Frequency Stability** Fundamentals. Definition of the different stages of a frequency event. Factors affecting frequency stability: inertia, regulation actions, primary reserve and headroom, governor droop, dynamic response of governors, under-frequency load shedding.
	Exercise: Frequency Stability in a Multi-Machine Network Frequency stability after generators outages. Effect of primary control, load modelling, replacement of conventional generation by renewable generation, a HVDC link and a Battery Energy Storage System. Area separation and load shedding. Comparison between different methods to improve frequency stability.
	Q&A session.
	End of the training course

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