



POWERFACTORY

Stability Analysis of Converter-Dominated Power Systems

Course Content

Digsilent Buyisa (Pty) Ltd

POWER SYSTEM SOLUTIONS
MADE IN GERMANY

Stability Analysis of Converter-Dominated Power Systems

2 Day Course

Objective:

The objective of the course is to provide a comprehensive overview about stability analysis of inverter-based resources (IBRs) and control problems combined with an introduction to the dynamic modelling and simulation environment of DIgSILENT PowerFactory.

Inverter-based resources (IBRs) are studied, using steady state, time-domain, and frequency-domain techniques, including both grid-following (GFL) and grid-forming (GFM) control paradigms. This four half-day course provides a comprehensive overview about the dynamic models of elements and stability types including frequency, subsynchronous, impedance-based stability:

- Fundamentals of Stability Analysis of Converter-Dominated Power Systems
- Overview of Relevant Technologies and Simulation Models
- Frequency Stability
- Subsynchronous Stability
- Impedance-based 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.**
- **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 16.

ECSCA CPD Accredited and Points:

- The course is fully accredited with the Engineering Council of South Africa (ECSCA).
- 2 CPD points for completion.



POWERFACTORY

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.

Training content

DAY 1

- 08:30 Introduction to Stability of Converter-Dominated Power Systems**
Motivation. Key Characteristics of inverter-based resources (IBRs) vs synchronous generation. Classification. New stability classes resulting from IBRs. Overview of power system dynamic modelling and simulation tools.
- 09:15 Exercise**
- 10:00 Tea/Coffee Break**
- 10:30 Overview of Relevant Technologies and Simulations Models**
Synchronous generator. Grid-following (GFL) and grid-forming (GFM) converters. Control strategies. HVDC. FACTS. BESS. Synchronous condensers.
- 11:15 Exercise**
- 12:30 Lunch Break**
- 13:30 Frequency Stability**
Impact of IBR generation on frequency stability. Countermeasures. Simulation models. Analysis tools and procedures. Screening metrics.
- 15:30 Tea/Coffee Break**
- 15:45 Exercise**
- Q & A Session**
- 16:30 End of the first day**

DAY 2



POWERFACTORY

08:30 Subsynchronous Stability

Subsynchronous stability. Low-frequency oscillations. IBR control loops. System strength. Tuning of controllers. Synchronous condensers. Grid-forming converters.

10:30 Tea/Coffee Break**10:45 Exercise****12:30 Lunch Break****13:30 Impedance-based Stability Analysis: IBSA - Single-connection assessment**

Theoretical background for the IBSA for single-connection analysis (SISO). Operating point dependency. Coupling over frequency effect.

Exercise: IBSA - Single-connection assessment**15:30 Tea/Coffee Break****15:45 Exercise: IBSA - Coupling over frequency effect****IBSA - Multi-connection assessment**

Theoretical background for the IBSA for multi-connection analysis (MIMO).

Exercise: IBSA - Multi-connection assessment**Q & A Session****16:30 End of Training**