

INFORMATION

Please complete and sign the registration form and return either via fax +49 7072 916 888 or a scanned copy via electronic mail to: c.koenig@digsilent.de. Upon submission of your registration you will receive an acknowledgement of receipt and invoice. Final confirmation will be established after receipt of payment.

Without this confirmation your registration is not valid. By our written confirmation your registration becomes legally binding.

CANCELLATIONS

Up to 8 weeks before the seminar: at no cost
Up to 2 weeks before the seminar: 50% of the seminar fee
After the 2 weeks' period: 100% of the seminar fee

DlgSILENT reserves the right to cancel a seminar due to insufficient participants up to 4 weeks before the beginning of the seminar. In the event that an already confirmed seminar needs to be cancelled due to force majeure, participants will be informed as soon as possible and already paid seminar fees will be reimbursed. Further claims like travel expenses or hotel cancellation fees are excluded from this practice if the cancellation of the seminar is not due to a grossly negligent behaviour of DlgSILENT GmbH.

Detailed information about how to get to DlgSILENT will be sent along with the confirmation.

LUNCHES

Lunches are included in the seminar fees. If you have any special requirements (e.g. vegetarian), please let us know with your registration.

TRAINING MATERIAL

Our training material is protected by copyright. Duplication or transfer is prohibited and requires the written consent of DlgSILENT GmbH.

ACCOMMODATION

We recommend booking your accommodation in one of the hotels listed below:

- Hotel Alznauer Hof, Raiffeisenstr. 2, 72810 Gomaringen
- Hotel Arcis, Bahnhofstr. 10, 72810 Gomaringen
- Hotel Nehrener Hof, Bahnhofstr. 57, 72147 Nehren
- Hotel Domizil, Wöhrdstr. 5-9, 72072 Tübingen

SEMINAR FEES:

For DlgSILENT Users with valid guarantee or maintenance period reduced seminar fees apply. Included in the seminar fees are training material, coffee breaks and lunches.

REGISTRATION

Company: _____

Department: _____

VAT No.: _____
(European Community)

First name: _____

Last name: _____

Street: _____

Zip Code: _____

City: _____

Country: _____

E-Mail address: _____

Participant's name: _____

Invoicing address: _____
(if different)

Signature: _____

For how long have you been using PowerFactory regularly?

New user > 1 year > 2 years > 5 years

By submitting the form you agree to the storage and use of your data to process your inquiry at DlgSILENT GmbH.

PRICE PER PARTICIPANT

Euro 726.00 plus VAT (**with** valid licence or maintenance agreement)
Euro 825.00 plus VAT (**without** valid licence or maintenance agreement)
Euro 248.00 plus VAT (with valid student ID)

DlgSILENT SEMINAR



Harmonic Analysis

S2017.1113.GO.HARM



13 - 14 November 2017

Training facilities at DlgSILENT GmbH in Gomaringen

INTRODUCTION

The training course gives an overview of simulation techniques in DlgSILENT PowerFactory for the assessment of power quality with an emphasis on harmonic distortion and reviews recommended practice for harmonic mitigation in power systems. Special attention is drawn to the power quality characteristics of converter-connected generation, such as wind or solar generation and the assessment of harmonic emissions according to IEC standards.

Besides the theoretical review of main power quality concepts, multiple hands-on exercises will help the participant to familiarise with the simulation tools in PowerFactory for harmonic analysis.

WHO SHOULD ATTEND

The course is intended to utility engineers, power system operators, project developers, manufacturers, consultants and electrical engineers in general, interested in the assessment and mitigation of harmonic distortion issues in power systems.

The participants should be familiar with the basic handling of DlgSILENT PowerFactory. Experience with PowerFactory's frequency domain simulation functions is not required.

PROGRAMME

DAY 1

- 13:30h Theoretical background**
Harmonic injections: balanced and unbalanced spectrums. Positive, negative and zero sequence injections. Harmonic load flow: calculation options. Total RMS values and total power. Power quality indices: HD, THD, THF, IT, TAD. Harmonic distortion diagrams and waveform plots. Harmonic distortion limits (IEC, IEEE, etc.).
- 15:00h Coffee break**
- 15:30 Exercise: Power quality assessment**
Definition of harmonic sources in a test network. Assessment of voltage distortion. Verification of distortion limits. Harmonic currents. Bar and distortion diagrams. Waveform plots.
- 17:00 End of the first day**

DAY 2

- 09:00 Frequency characteristic of network components**
Frequency response of relevant network components: Cable and overhead lines, network equivalent impedance, loads, transformers. User defined frequency characteristics.
- 09:45 Exercise: Frequency sweep**
The frequency sweep tool in PowerFactory: handling, results, calculation options. Impedance plots. Assessment of series and parallel resonances. Self and mutual network impedances.
- 10:30 Coffee break**
- 11:00 Harmonic mitigation**
Overview harmonic filters: single-tuned band pass filter, damped high pass filter, C-type filter. Design criteria.
- 11:30 Exercise: Filter design**
Filter sizing for grid connection compliance. Layout and design parameters. Verification of filter ratings. Filter report and layout report.

- 12:30 Lunch Break**
- 13:30 Power quality assessment acc. to IEC**
Harmonic load flow calculation acc. to the IEC 61000 standard. Positive sequence harmonic spectrum. Summation laws for harmonic emission coordination with multiple sources. Assessment of flicker assessment emission level (IEC61400-27).
- 15:00 Coffee break**
- 15:30 Exercise: Power quality assessment of a wind park acc. to IEC standards**
Harmonic injection of the wind turbines. Calculation of voltage distortion at the point of common coupling. Consideration of background distortion. Design of harmonic filters. Assessment of the flicker emission of the wind park.
- 17:00 End of the course**



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