Training Content

Dynamic Modelling with Modelica and FMI

DAY 1

MODULE 1: Dynamic Modelling Approach in *PowerFactory*

Dynamic Modelling Approach in *PowerFactory* 1/2 h

Dynamic systems modelling for power systems analysis;

Model Specifications/Requirements of User-Defined Models (UDM);

High-level Control System Representation of UDMs;

Time-continuous and time-discrete systems;

RMS- and EMT-domain power system simulations.

Exercise: Dynamic Modelling Approach 1/2 h

Identify and familiarise with dynamic controls and connection patterns associated to power system equipment elements.

Dynamic Modelling Handling 1/4 h

Model type/element handling. Identification of various dynamic models.

Exercise: Include Dynamic Models in a Network 1/4 h

Instantiation of dynamic models based on existing types.

Coffee break

Dynamic Modelling Concepts 1/2 h

Interpret and visualise a functional block diagram. Identify the transfer function in a block diagram.

Exercise: Interpret a Block Diagram 1/4 h

Investigate a block diagram;

Run a simulation and plot model signals.

MODULE 2: Introduction to Modelica and Graphical Modelling

Introduction to Modelica and Graphical Modelling 3/4 h

Overview of the Modelica Language and the Modelica Language Specification.

Q&A session

Lunch break

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Introduction to the Modelica and Graphical Modelling 3/4 h

Graphical and scripted modelling environment for Modelica models within *PowerFactory*.

Exercise: Development of a current controller for an IBR converter 3/4 h

Create, debug and parameterise a simple controller model.

Coffee break

Exercise: Development of a current controller for an IBR converter 1 1/2 h

Steady state operation: setting initial conditions of the developed model;

Dynamic simulation: controller response and analysis;

Run simulations and plot model signals.

Q&A session

DAY 2

MODULE 2: Development and integration of time-discrete Modelica models

Model development: workflow and tools for creation of complex UDMs 1 h

Model structure: Type Instances/Submodels, algorithms, parameterisation, initialisation;

Model flexibility: data types, scalar/array variables, conditional components.

Exercise: Develop further controls for an IBR converter 1/2 h

Create, debug and parameterise a control system for a converter based generator;

Operating with array signals in Modelica models and in the Composite Model Frame.

Coffee break

Exercise (continued): Develop further controls for an IBR converter 1 1/2 h

Steady state operation: setting initial conditions of the developed model;

Debugging/analysis of model behaviour for various operation scenarios;

Dynamic simulation: controller response and analysis;

Creating a complete power equipment simulation model by means of a general template.

Q&A session

Lunch break

Exercise (continued): Develop further controls for an IBR converter **1½ h**

Steady state operation: setting initial conditions of the developed model;

Debugging/analysis of model behaviour for various operation scenarios;

Dynamic simulation: controller response and analysis;

Creating a complete power equipment simulation model by means of a general template.

Coffee break

MODULE 3: The Functional Mock-up Interface (FMI)

FMI as a comprehensive solution for model exchange in power systems **¾ h**

Vendor-independent, tool-independent model interfacing for simulation of power system components;

FMI as a common standard for exchanging dynamic models between OEMs and Utility operators. Tools supporting FMI;

Functional Mock-up Units (FMUs): structure, specifications, data protection and cross-platform compliancy;

FMI Import: Integration of FMUs within *PowerFactory*;

FMI Export: Exporting *PowerFactory* Modelica models as FMUs.

Exercise: Integration into *PowerFactory* of an FMU-based controller for PE converters **½ h**

Set-up and configuration of the FMU (FMU Import);

Troubleshooting cases, simulation settings and compatibility requirements.

Exercise: Export of a Modelica converter control model using FMI **¼ h**

Set-up and configuration of the Modelica model for export purposes;

FMU export.

Q&A session

DIgSILENT GmbH
Heinrich-Hertz-Str. 9
72810 Gomaringen
Germany

T +49 7072 9186-0
F +49 7072 9168-88
mail@digsilent.de

www.digsilent.de

Time Schedule (Central European Time)

Full-Day	Time
First 90 minutes block	9:00
Coffee break	10:30
Second 90 minutes block	10:45
Q&A session	12:15
Lunch break	12:30
Third 90 minutes block	13:30
Coffee break	15:00
Fourth 90 minutes block	15:15
Q&A session	16:45
End of the training day	17:00

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