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Electric machines teaching laboratory

Courseware

OP1160

"This courseware helps to master synchronous and asynchronous machines, from parameter identification to full operation in generator and motor modes."

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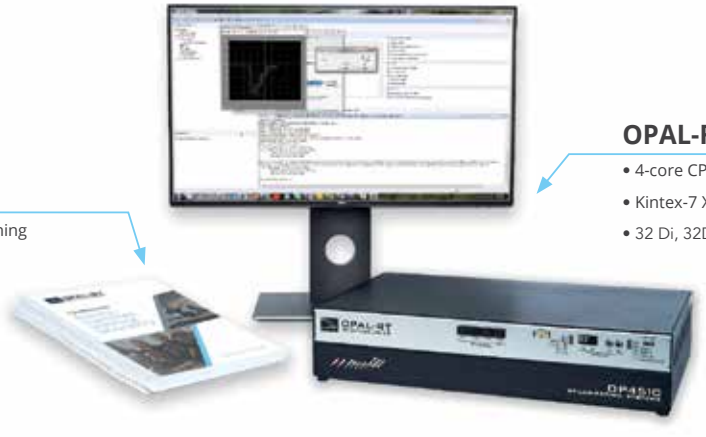
The electric machines teaching laboratory constitutes a fundamental learning tool to thoroughly understand synchronous and asynchronous machines.

Students are in-the-loop, interacting with virtual machines and doing experiments as they woud with physical test benches. As a result, they will fully grasp steady-state model parameter identification, synchronous machine motor operations and asynchronous machine speed control.

MAIN BENEFITS

- An interactive user interface brings the students into the loop and allows them to perform step-by-step experiments.
- Avoid costly damage or significant impact that could be caused by errors, such as overspeeding.
- Protection is implemented and allows students to reset the experiment, making it possible to recover from mistakes.

COURSEWARE KIT



COURSEWARE

Electric machines teaching laboratory
10 Modules

OPAL-RT OP4510

- 4-core CPU, Xeon E3 3.5 GHz
- Kintex-7 XILINX FPGA, 325T
- 32 Di, 32Do, 16 Ai, 16Ao

OUR ELECTRIC MACHINE TEACHING LABORATORY COMES IN TWO SECTIONS WITH FIVE MODULES EACH

SYNCHRONOUS MACHINE

OBJECTIVES

- Learn the principles of operation of synchronous machines.
- Identify steady-state model parameters.
- Understand dynamics, stability and power flow control.

MODULE 1:
Parameters Identification

Laboratory Exercises include:

Experimental parameter identification for the steady state synchronous machine model.

MODULE 2:
Generator Mode-Passive Load

Laboratory Exercises include:

Synchronous generator feeding a variable passive load, without being connected to the grid.

MODULE 3:
Generator Mode-Grid Connection

Laboratory Exercises include:

Synchronous generator connected to the grid: power flow analysis and stability limits.

MODULE 4:
Motor Mode

Laboratory Exercises include:

Synchronous motor coupled to a DC generator feeding a variable resistor, thus achieving variable torque on motor shaft.

MODULE 5:
Faults & Recovery

Laboratory Exercises include:

Three-phase short-circuit test and recovery of the synchronous machine voltages after clearing fault.

ASYNCHRONOUS MACHINE

OBJECTIVES

- Learn the principles of operation of asynchronous machines.
- Identify steady-state model parameters.
- Apply various procedures for speed control.

MODULE 1:
Transformer & Frequency Converter

Laboratory Exercises include:

Wound-rotor asynchronous machine operating as a phase shifter transformer and frequency converter.

MODULE 2:
Parameters Identification

Laboratory Exercises include:

Experimental parameter identification for the steady state asynchronous machine model.

MODULE 3:
Speed Control-Variable Voltage

Laboratory Exercises include:
Speed control of the asynchronous motor using variable voltage and fixed frequency.

MODULE 4:
Speed Control-Variable Resistance

Laboratory Exercises include:

Speed control of the wound-rotor asynchronous motor using variable rotor resistance.

MODULE 5:
Speed Control-Three-Phase Inverter

Laboratory Exercises include:

Speed control of the asynchronous motor using a three-phase inverter with variable voltage and frequency.