OPAL-RT TECHNOLOGIES

Electrical & Robotics Courses

www.opal-rt.com/university

" Tell me and I forget, teach me and I may remember, involve me and I learn."

Benjamin Franklin

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Courses

OPAL-RT University has leveraged its extensive expertise, in terms of education, to move beyond the products trainings and to start offering courses in the field of electrical and robotics engineering.

These courses start by covering thoroughly theoretical material then suggest a series of laboratory manipulations, where the users enrolled in the course will put their knowledge into practice by interacting with virtual test benches.

Electrical Courses

Electrical courses cover various topics such as fundamentals of electrical engineering, power electronics, electric machines, electric motors drives, and renewable energy. The courses are using courseware as virtual laboratories because the hands-on experience they provide ensures a better understanding of each topic.

Enroll in a course now!

Fundamentals of Electrical Engineering

TRN-OP1110-TUTOR

This course is intended to teach the fundamentals of electrical engineering; passive elements (resistances, inductances and capacitors), single- and three-phase transformers, DC and AC sources, scopes, and measuring instruments. As a result, users will fully grasp the fundamental notions of electric circuit theory, delta/star, series/parallel, hybrid connections, steady-state and transient analysis, instantaneous, mean, and RMS values, balanced and unbalanced systems, among others.

CONTENTS

- Measurement & Instrumentation
- Electric Circuit Components & Configurations
- Electric Engineering Systems
- Electric Transformers

COURSE DURATION

- 2 Days (online)

PRE-REQUISITES

- None

Electric Machines
TRN-OP1160-TUTOR

This course is intended to teach the fundamentals of synchronous and asynchronous machines. Additionally it covers a new model showing the transient stability in power systems based on a synchronous generator. As a result, users will fully grasp the identification of steady-state model parameters, synchronous machine generator and motor operations, and asynchronous machine speed control. As a final step, they will use the corresponding electric machines courseware and will be in the loop interacting with virtual machines and doing experiments as they would with physical test benches.

CONTENTS

- Synchronous Machine (Parameters identification, Synchronous Generator with Passive Load, Synchronous Generator Connected to the Grid, Synchronous Motor, Fault & Recovery)
- Asynchronous Machine (Parameters Identification, Transformer and Frequency Converter, Speed Control with Variable Voltage, Speed Control with Variable Resistance, Speed Control with Three-phase Inverter)
- Transient Stability

COURSE DURATION

- 4 Days (online)

PRE-REQUISITES

- Basic notions in electrical engineering or Fundamentals of Electrical Engineering Course

Power Electronics
TRN-OP1130-TUTOR

This course is intended to teach power electronics converters; such as choppers (buck, boost, buck-boost), rectifiers (single- and three-phase, diode- and thyristor-based), inverters (single- and three-phase, two- and three-level NPC). Notions of PWM frequency, duty cycle, harmonic analysis, power flow computation, and filtering are thoroughly addressed.

CONTENTS

- Power Electronics Switches Classification
- Power Electronics Converters Classification
- Choppers (DC/DC): buck, boost, buck-boost
- Rectifiers (AC/DC): single- and three-phase, diode- and thyristor-based
- Inverters (DC/AC): single-phase full bridge, three-phase two-level bridge
- Converter (DC/AC & AC/DC): three-phase three-level NPC

COURSE DURATION

- 4 Days (online)

PRE-REQUISITES

- Basic notions in electrical engineering or Fundamentals of Electrical Engineering Course

Renewable Energy
TRN-OP1142-TUTOR

This course is intended to teach elements of renewable energy such as battery energy storage systems, photovoltaic generation system, and wind turbine generation system, including different control and mitigation strategies used by power systems operators and utilities. Notions of maximum power point tracking, load shedding, demand response, and power flow are thoroughly addressed.

CONTENTS

- Battery Energy Storage System
- Photovoltaic Generation System
- Wind Turbine Generation System
- Microgrid

COURSE DURATION

- 3 Days (online)

PRE-REQUISITES

- Basic notions in electrical engineering or Fundamentals of Electrical Engineering Course
- Power Electronics Course
- Electric Machines Course

Electric Motors Drives
TRN-OP1120-TUTOR

This course is intended to teach various control strategies implemented in variable speed drives. Users grasp a deep understanding of concepts such as torque and speed linear control for brushed-DC motors, hysteresis self- and vector-current control for PMSM, indirect FOC for induction motors, and vector control for doubly fed induction motor. Additionally, switches-based converters are employed in the scheme instead of the commonly used averaged models.

CONTENTS

- Brushed-DC Motor Drive
- Squirrel-cage Induction Motor Drive
- Permanent Magnet Synchronous Motor Drive
- Doubly Fed Induction Motor Drive (DFIM)

COURSE DURATION

- 4 Days (online)

PRE-REQUISITES

- Basic notions in electrical engineering or Fundamentals of Electrical Engineering Course
- Power Electronics Course
- Electric Machines Course

Robotics Courses

Robotics courses guide learners through various robots such as serial robotics manipulators, wheeled mobile robots, to finally reach more complex autonomous off-road vehicles. The courses use the OPAL-RT robotics courseware for an enhanced hands-on experience.

Enroll in a course now!

Serial Robotics Manipulators
TRN-OP1170-TUTOR

This course is intended to teach serial robotics manipulators to users. Therefore, they will grasp deep understanding of concepts such as: DH-Table, direct and inverse displacement analysis, decoupled and non-decoupled architectures, kinetostatics and Jacobian analysis, dynamics, trajectory generation and tracking, pick-and-place operation, position and speed joints control, linear and non-linear end-effector control, and force-based control. The covered architectures are: 3 dof (degrees-of-freedom) planar robot, FANUC LRMate 200iC, and UR10e.

CONTENTS

- Three-DOF Planar Horizontal Robot
- Six-DOF Spatial Decoupled Manipulator – FANUC LRMate 200 iC
- Six-DOF Spatial Non-decoupled Manipulator – UR10e

COURSE DURATION

- 4 Days (online)

PRE-REQUISITES

- None

Wheeled Mobile Robot
TRN-OP1171-TUTOR

This course is intended to teach wheeled mobile robots to users. Therefore, they will grasp deep understanding of non-holonomic constraints, kinematics and dynamics models. Control strategies for navigation include: one-chained system form, input-output linearization, unstable zero-dynamics, Lyapunov function for navigation, and sliding mode. The architectures covered are differential-drive, Ackermann-based steering, articulated-based steering, and wheeled pendulums.

CONTENTS

- Ackermann-based Steering
- Articulated-based Steering
- Differential-drive Robot
- Mobile Wheeled Pendulum

COURSE DURATION

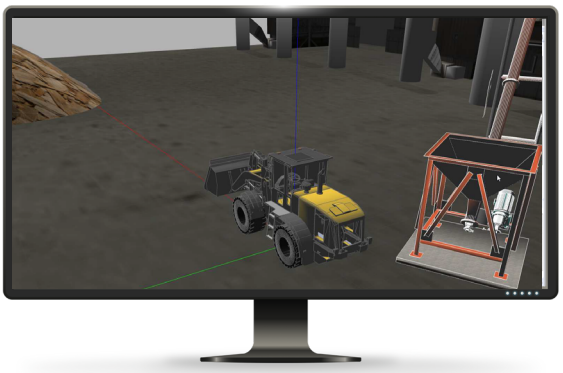
- 4 Days (online)

PRE-REQUISITES

- None

Autonomous Off-Road Vehicles

TRN-OP1172-TUTOR



This course is intended to teach autonomous applications of off-road vehicles. Three architectures are proposed: (i) a differential drive robot carrying a UR10e to move in a warehouse, (ii) an Ackermann-based steering tractor with a 3 dof (degrees-of-freedom) planar mower arm to drive on a highway and cut the grass, and (iii) an articulated-based steering tractor with a loader arm, and bucket to load/unload material in a construction/mill court.

CONTENTS

- Differential-drive Robot Platform & UR10e
- Ackermann-based Steering Tractor & Mower Arm
- Articulated-based Steering Wheeled Loader
- Sensors: LIDAR, IMU, GPS

COURSE DURATION

- 4 Days (online)

PRE-REQUISITES

- Serial Robotics Manipulators Course
- Wheeled Mobile Robots Course

Our Worldwide Locations

OPAL-RT is the world leader in the development of PC/FPGA Based Real-Time Digital Simulator, Hardware-In-the-Loop (HIL) testing equipment and Rapid Control Prototyping (RCP) systems to design, test and optimize control and protection systems used in power grids, power electronics, motor drives, automotive industry, trains, aircraft and other various industries, as well as R&D centers, and universities.

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