



**POLITECNICO**  
MILANO 1863

DIPARTIMENTO DI MECCANICA

# Electric Drives

## Laboratory of electrical drives and power electronics for industrial and automotive applications

### Description:

The laboratory of electrical drives and power electronics can test electric motors, power converter and control system both for industrial application (traction, grid interface) and automotive applications (hybrid and full electric vehicles).

Thanks to two different test rigs electric drive of a power up to 100 kW and torque up to 1500 Nm can be tested. In the laboratory, battery cell life test and identification test can also be performed.

Thanks to our expertise, customized (high-efficiency) power electronics hardware based either on silicon and wide-bandgap semiconductors can be developed according to the customer requirements.

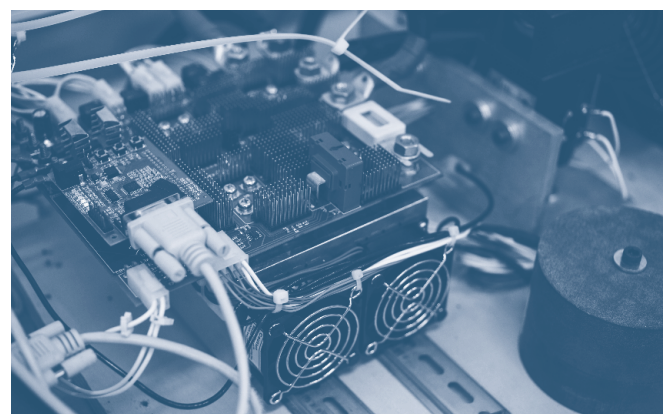
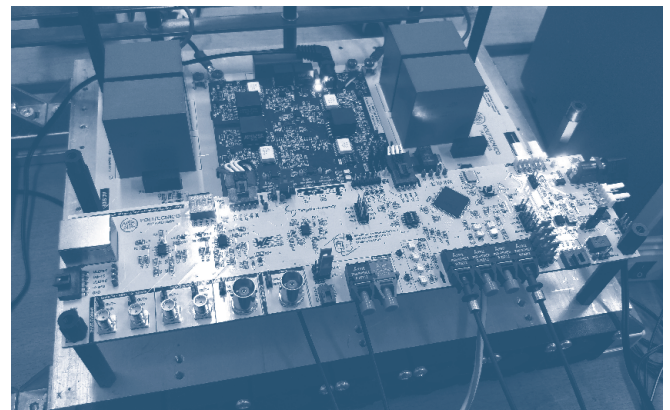
Moreover, wired or wireless solutions for condition monitoring of power electronics equipment are available.

### References:

ABB, Siemens, Ansaldo, HSD, CIFA, OEMER, Nice, Bosch Rexroth, Ferrari, Piusi, Whirlpool, Skema, Lucchini RS, Fimer

### Instruments & Facilities:

- 100kW Motor test bench (2500Nm/6500 rpm).
- Regenerative Motor Test Bench (35Nm/7500rpm) with PC based Data Acquisition and Control system and Power Analyzer Yokogawa PZ4000.
- Power Supply Units (1500W): 600V-2.5A; 300V-15A, 12,5V-120A.
- E4360A Modular Solar Array Simulator Mainframe, E4362A Solar Array Simulator DC Module, 130V, 5A, 600W.
- dSpace Real-Time board for electrical drives prototyping.
- Electrolyzer for Hydrogen production.
- Active load for battery cells testing.
- Scopes, Current probes, Insulated Voltage probes, Industrial Electrical Drives, Laboratory Power Supplies.



- Development system for Embedded hardware and software (microchip, Freescale, TI, STM) and Static Converters.
- 30kW IGBT-based three-level T-type three-phase converter with sensing interface (ETH, CAN, UART)
- 35kW IGBT-based H-bridge two-level converter module with sensing interface (aimed to modular connection towards MMC topologies)
- 20kW SiC-MOSFET-based two-level three-phase converter with sensing interface (ETH, CAN, UART)
- Modular LCL-filter with distributed sensors and related interface (ETH)
- Teaching kits for university students and/or academic initiatives: motor-control kit (BLDC, IM), power conversion kit (DC-DC, PV, MPPT)

#### Activities:

HSD AC motors High efficiency Electric Motor Testing

- No load test and magnetizing curve.
- Parameters identification test.
- Load test, efficiency measurement and thermal behavior.
- Full speed test in field weakening condition.
- Test on ac induction and ac permanent magnet synchronous motor.

Electric drive test for household application

- Parameters identification test.
- Load test, efficiency measurement and thermal behavior.
- Full speed test in field weakening condition.
- Test on ac permanent magnet synchronous motor with vector sensorless control.

Battery life cycle test

- Rated current charge/discharge test for cell capacity identification.
- Life test under rated condition.
- Life test under variable current and temperature condition.
- Equivalent Electric circuit identification test.

Battery Power Electric drive for hybrid electric vehicle test

- Traction curve identification.
- Regenerative Braking test.
- Drive cycle test.
- Overall efficiency measurement.

Small PEM Fuel Cell (<1.5 kW) Test bench

- Equivalent Electric circuit identification test.
- Parameters identification test.
- Load test, efficiency measurement and thermal behavior.

Solar Simulator

- MPP Validation.
- Solar Inverter Tests-Rig.

Methods to achieve enhanced reliability of power electronic systems

- Reliability model of most fragile components of power electronic equipment used in traction drives and grid interface
- Development of wired or wireless solutions (e.g. BLE) for condition monitoring of power electronics equipment
- Development of customized (high-efficiency) power electronics hardware based either on silicon and wide-bandgap semiconductors.

