WINPOWER
Integration of Renewable Energy Sources by a High Voltage Direct Current Grid

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Project description

WINPOWER project aims at developing a wide control strategy to manage large scale High Voltage Direct Current (HVDC) multi-terminal networks that will interconnect renewable energy sources (RES) to the main power network. The work deals with control strategies in a wide sense, from off-line optimization of network itself before its construction; to real time, multi layered, decentralized stabilizing control that is embedded into its components. This DC grid will allow for multi-RES generators efficient interconnection, for example off-shore Wind Farms (WF) and solar plants. This DC grid will also manage their connection to: the main AC grid; large loads (big cities or industrial facilities); other DC grids like a future European SuperGrid.
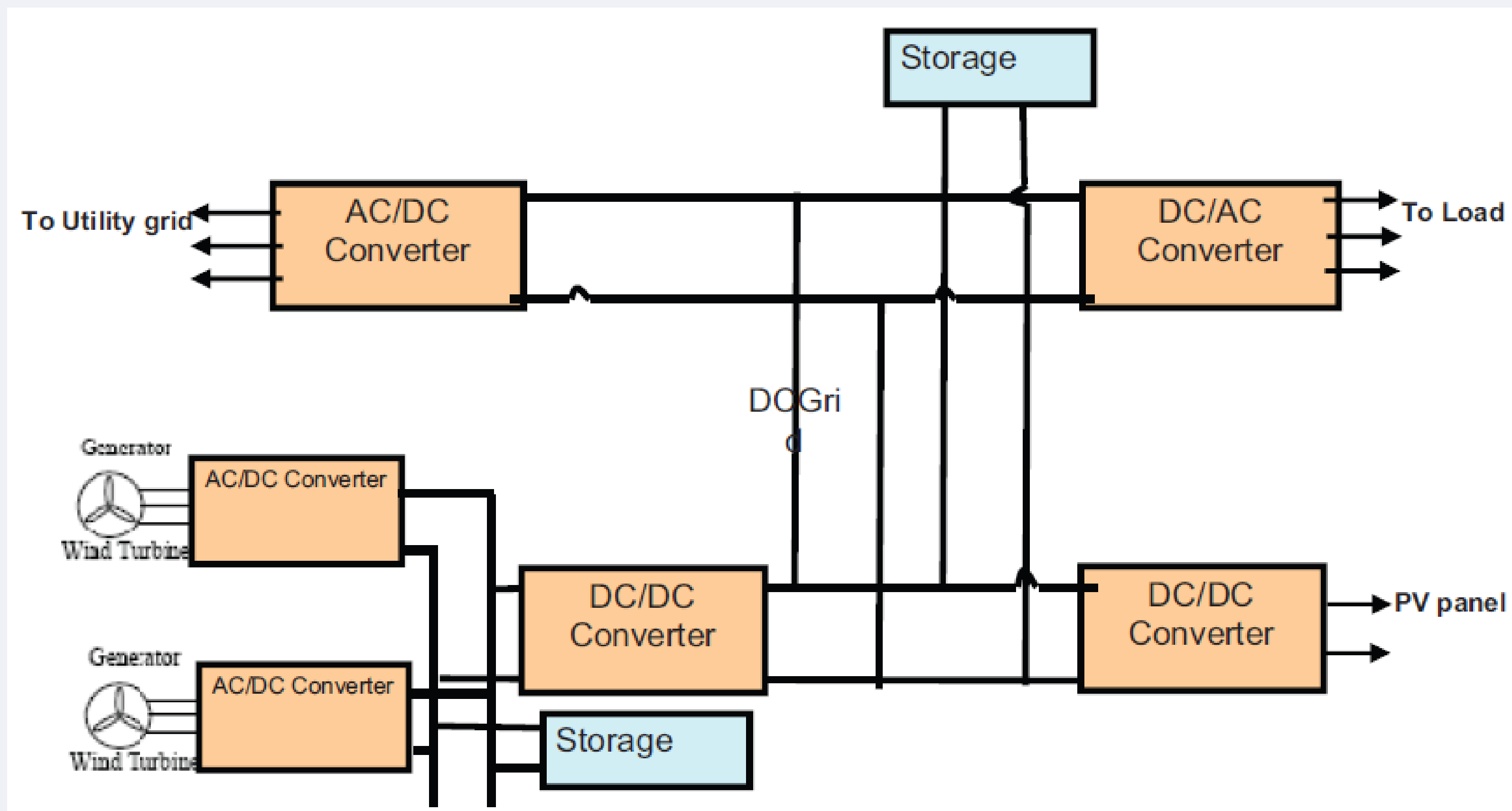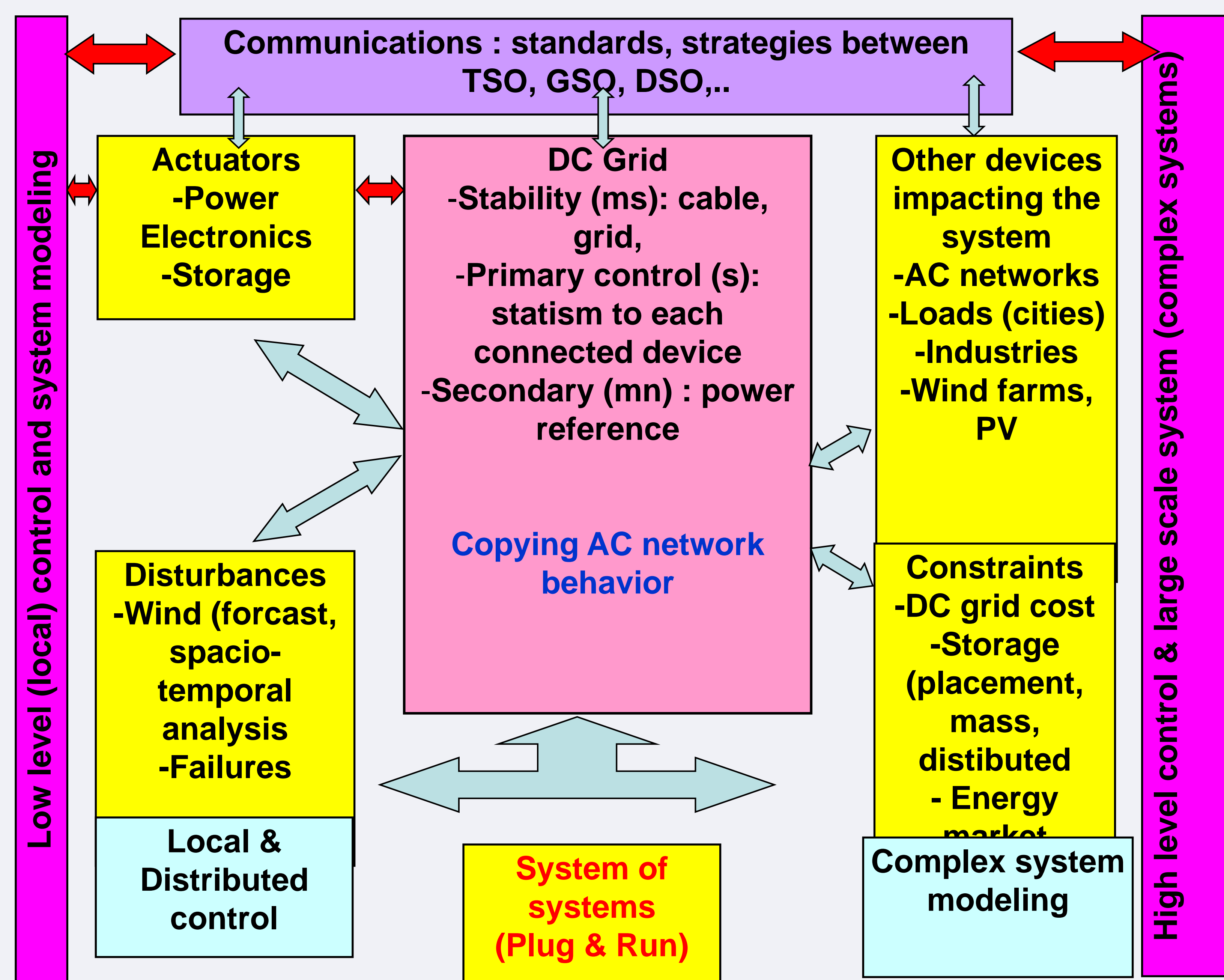

Keywords

- Wide control strategy
- HVDC multi-terminal networks
- Renewable energy sources (RES)
- Interconnection to the main power network
- Off-line optimization

- Real time, multi layered, decentralized stabilizing control
- Interconnection to other DC grids like a future European SuperGrid

Challenges

- Control of multi-terminal HVDC network
- Network modeling and parameter identification
- Remote information integration
- Integration of weather forecast and economics into the control
- Better use of storage components

Communications : standards, strategies between TSO, GSO, DSO,..

Low level (local) control and system modeling

Actuators
-Power Electronics
-Storage

DC Grid
-Stability (ms): cable, grid,
-Primary control (s): statism to each connected device
-Secondary (mn) : power reference

Copying AC network behavior

Other devices impacting the system
-AC networks
-Loads (cities)
-Industries
-Wind farms, PV

High level control & large scale system (complex systems)

Disturbances
-Wind (forcast, spacio-temporal analysis
-Failures

Local & Distributed control

Constraints
-DC grid cost
-Storage (placement, mass, distibuted
- Energy market

Complex system modeling

System of systems (Plug & Run)

New control systems

- System modeling
- External parameter Identification
- Better use of remote information – observers
- Integration of weather forecast
- Integration of economics information (real-time market)

- Hierarchical control system:
  - ✓ Computer Science – Multi-agents
  - ✓ Robust and nonlinear control
  - ✓ Real-time imbedded system
  - ✓ Hybrid control (Intermediate level)

Partners