LABORATORY OF ELECTRICAL ENGINEERING AND POWER ELECTRONICS

# Power-Grid supporting using high-power SiC reversible Automotive battery charger

Postdoctoral Research position, 24 months, Lille, France

**Scientific context:** Due to CO2 saving energy policies, the electricity production system has been moving towards a decentralized scheme, with more and more low-power production means distributed on the territory (wind or solar power plants). For this new power system, the stability problem is no longer the exclusive responsibility of a limited number of large power plants using high power synchronous rotating machines as generators. Now, any active-source or -load, connected to the grid with help of a Power-Electronics (PE) converter, has the ability to improve or damage overall stability of the grid. In this context, H2020 European project MIGRATE ( *https://www.h2020-migrate.eu/* ) assessed the operating rules of a hypothetical 100% Power-Electronics grid. Since MIGRATE project, L2EP Power-System team has been recognized as an international expert in Power-Electrics control, especially when the converter offers stability services to the power system. "Grid-Forming" control theory was born from this context. In parallel, recent research, about carbon-constrained power-system and about electrification of the automotive powertrain, have identified the energy stored in automotive batteries as an opportunity to cover several technical challenges. First, for the power system operators, this energy could be used to operate grid ancillary services such as: Frequency containment support, voltage support, grid congestion prevention, or even to respond to the problematic of renewable energy production intermittency. Then, Automotive industry defines new V2X operating modes when the electric car becomes an energy source: Vehicle2Grid if offering ancillary services when connected to to the grid, or Vehicle2Load, Vehicle2Home, Vehicle2Building, Vehicle2Vehicle, in islanded conditions (disconnected from the grid). As far as Power-Electronics is concerned, these two classifications lie on the same technical paradigm: The PE converter must be able to transfer energy in reversible ways of conversion (from the grid to the battery or reversely).

## In collaboration with

Valeo SIEMENS eAutomotive

## Period

From 09/2021 to 08/2023, to be adjusted according to the applicant availability

## Required skills and tools

Electrotechnics / Power Electronics

3-Phase systems control design

Matlab Simulink: Simulation, SW design

## Application procedure

To apply for this job, please send:

- Curriculum Vitae
- One-page cover letter
- Reference letter (if any)

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**Job mission:** In this context, the Automotive electrification supplier Valeo-Siemens is developing a new range of reversible battery chargers, embedding SiC wide bandgap semiconductors. To take the whole benefit of the Power-Electronics converters, new control laws are required, especially in reversible energy transfer conditions. This job is proposed in the context or a collaboration between Valeo-Siemens and the L2EP, carried out within the framework of a European project about SiC technology development. The mission consists in developing and integrating the software control laws into the reversible battery charger designed by Valeo-Siemens, focusing on V2X operating modes. The method consists in: First, to learn in a simulation environment (Matlab Simulink) the grid-forming control technics developed at the L2EP. Then, to rework these control technics to cover the Automotive charger functional requirements. At last, experimental validations will be held at L2EP experimental platform ( https://www.epmlab.eu/ ), on Valeo-Siemens charger prototype.

**Acknowledgement**

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