# Internship Offer: DynaLink

Dynamic Performance Improvement through Grid Connectivity Adjustment

**Duration:** 5 to 6 months
**Desired start:** Between March 2026 and July 2026
**Internship level:** Master's / Final-year Engineering student
**Location:** Laboratory of Signals and Systems (L2S), French research laboratory located in Paris-Saclay University - RTE Chair "The Digital Transformation of Electricity Networks"
**Contact:** Patrick Panciatici and Sorin Olaru.

## 1 RTE Chair at CentraleSupélec

The RTE Chair is a partnership between RTE and CentraleSupélec, coordinated by Prof. Sorin Olaru. For several years, RTE has been studying the potentialities offered by digital technologies in the management of the electrical system.

Building on its close scientific and educational relationships with CentraleSupelec, RTE has sought to strengthen this collaboration and establish this new partnership in the long term in order to accelerate its innovation processes and benefit from the scientific expertise of leading research teams with which to interact in the field of engineering sciences.

RTE is the operator of the French high- and extra-high-voltage transmission network. RTE provides a public service mission by guaranteeing the proper functioning and security of the power system in France. It operates, maintains, and develops the transmission grid to meet the needs of its customers, while ensuring economic efficiency, environmental responsibility, and supply security.

Its central role in the French and European power system makes RTE a unique pioneer in anticipating energy futures.

## 2 Context

Large-scale power systems are undergoing radical change. The transition to a low-carbon or even zero-carbon economy is driving electricity generation from non-carbon sources and increasing electrification in energy-intensive sectors. This shift raises critical questions about the integration of renewable energy into the grid, which power system stakeholders must address.

As complexity grows, ensuring reliable operation becomes more challenging. Modern power systems, now intricate cyber-physical networks, require advanced engineering solutions. Renewable energy sources—primarily solar and wind—are inherently variable and rely on stochastic primary power flows. They typically connect to the AC grid via power electronic converters at various power and voltage levels, introducing highly controllable elements capable of rapid response.

To manage this complexity, automatic control is essential, leveraging feedback strategies to mitigate disturbances and enhance performance while avoiding costly, over-sized infrastructure. However, as more active devices emerge at the system's edge, centralized control becomes impractical and fragile. In this context, distributed control is a necessity.

A structured approach based on hierarchical control and protection strategies is required to ensure stability and efficiency in large power systems undergoing transition, taking into account the inherent separation of time scales in system dynamics.

## 3 Internship Objectives

This internship focuses on improving dynamic performance through grid connectivity adjustments. For decades, RTE has used these adjustments to manage steady conditions or immediate post-fault conditions rather than to improve the system's overall dynamic behavior.

Our main objective is to improve our understanding of the relationship between the graph structure of the electrical grid and the overall dynamic behavior of the system. To begin, we will start with a simple dynamic model that captures electromechanical oscillations in the power system, as the one proposed in the paperInput-Output Properties of the Power Grid's Swing Dynamics: Dependence on Network Parameters.

## 4 Internship Plan

The main steps are as follows:

1. Understand and formulate the problem
2. Understand the test case from the aforementioned paper. Then, write a MATLAB/Python code to simulate it. Next, review the topology and add details that allow for node merging and splitting.
3. Run simulations to analyze how the graph structure affects dynamic behavior.
4. Investigate the possible link between stability margins and the smallest non-zero eigenvalue of the graph's Laplacian matrix. This eigenvalue is also referred to as the spectral gap, algebraic connectivity, or the Fiedler value.
5. Find a heuristic that determines the optimal graph structure for achieving the best dynamic behavior.

This internship is intended to lay the groundwork for more in-depth doctoral study on the same topic. Students interested in pursuing a Ph.D. after the internship will be given priority consideration.

Thanks to the RTE Chair at CentraleSupélec, this work will be carried out in close collaboration with RTE.

## Profile and Skills

The selected student must have strong analytical skills, be capable of working autonomously, and have a logical approach to problem-solving. Knowledge of automatic control, electrical engineering, and mathematical programming is desirable. The student will perform software development and data preparation tasks. Proficiency in MATLAB/Python and an interest in programming are preferred.