CENTRALE NANTES

Teaching & Research Assistant in
Analysis and Control of Future Smart Grids

Key words: power systems, smart grids, renewable energy, power converters, control for ancillary services, power systems with high penetration of power electronics

Context: Ecole Centrale Nantes (ECN) is fully involved in Renewable Energies (RE) technologies such offshore and onshore wind, wave and solar. ECN tackles some important thematics of control of modern power systems and grids both in teaching and research.
ECN will coordinate the newly awarded by the European Commission Erasmus Mundus Master's degree **DREAM - European Master in Dynamics of Renewables-based Power Systems – from 2022 to 2027.** This 2-years Master will prepare specialists for the energy transition in smart grids of the future.
The *system view* will be promoted as a way to face challenges of smart grids of the future: stability issues dues to massive integration of power electronics and renewables, new grid reinforcements (HVDC lines/grids), new renewable energies and their integration to the grid and ancillary services, etc.
Because of increased dynamic interactions and complexity, problems can no longer be treated one by one based on separation hypothesis and next solutions packed together. A *system-based approach*, which takes into account dynamic interactions and a (as much as possible) *global/system view* is needed. For this, the actual framework of reflection/knowledge in power systems both at the specification as well as at the methodological levels will be enriched with concepts for modeling, analysis and control from the automatic control community. This should be finely merged with knowledge about material (power converters, new technologies of renewable generators, …).
As a consequence, this project has a strong interdisciplinary nature being at the interface of several scientific disciplines:
-   power systems for the general system specifications and operation: stability definitions and assessment, ancillary services, regulatory framework, link with energy and power markets and price signals
-   automatic control: analysis of system stability, performance, robustness, and resilience and synthesis of controllers to achieve these, aggregation/disaggregation of specifications/controls
-   power electronics: modelling, analysis and control of power converters inserted in AC grids. Their rapid dynamics – in a range of frequency much higher than the one of the classic dynamics of conventional power systems – and no/very low inertia require special cautions is modelling, simulation and control
-   renewable energies based on different principles, related to fluid dynamics (wind), photoelectric conversion (PV), thermal power conversion (solar thermal), etc.

These thematics are also strongly developed at research level. *Dynamics of Smart Grids* team of LS2N-ECN has, from 2020 to end 2023, the lead of the H2020 POSYTYF project (https://posytyf-h2020.eu/). This project is a Research and Innovation action of the EC focused on the development of an innovatory concept of Dynamic Virtual Power Plant (DVPP). The latter is supposed to allow an optimal portfolio of dispatchable and non dispatchable RE sources. Dynamics in the sense of stability assessment and control for RE sources participation to ancillary services are in the center of the project.

Tasks: The candidate will:
-   Participate till September 2022 in pedagogical preparation of DREAM classes that will be given in Nantes
-   Participate from September 2022 in teaching of DREAM classes in Nantes
-   Participate in research in the fields mentioned above in POSYTYF project. Actual topics are: grid/secondary frequency and voltage controls (ancillary grid services) for the DVPP, stability assessment for power electronics dominated systems, hardware in the loop (with important grid software emulation) implementation and testing of new controls, grid forming vs grid following control of renewables

Competences needed:
The candidate should have background and experience in interconnected power systems and transmission grids, in particular in control and stability assessment for grid/ancillary services in modern power systems with high rate of power electronics. Please provide the names and contacts of 2 or 3 referees (if possible, not exclusively the PhD advisors). HIL based on power electronics benchmarking with grid emulation experience would be a plus.

Schedule:
Recruitement: asap
Duration : 12months with possibility of extensions
Work will take place in ECN, Nantes-France.

Contact:
B. Marinescu, Ecole Centrale Nantes, head of the *Dynamics of Smart Grids* team of LS2N-ECN, Coordinator of the H2020 POSYTYF and Erasmus DREAM projects, Bogdan.Marinescu@ec-nantes.fr, (33) 2 40 37 69 46