Open Postdoctoral position

ANR-PEPR project: Strategic Power Systems Development for the Future (PowerDev)

Research topic: Proactive disaster response mitigation modeling and data-driven optimization for resilient power systems

The project: Strategic Power Systems Development for the Future (PowerDev) funded under an ANR-PEPR is looking for a postdoctoral researcher working on optimization methods and reliability/resilience engineering applied to large-scale electrical power systems. The project is led by CentraleSupélec at the University of Paris Saclay and is composed of a consortium of higher education institutions across France (CentraleSupelec, UVSQ, University Grenoble Alpes) as well as research organizations (Inria, CNRS).

The main objective of this project is to evaluate and optimize the resilience of power systems in the context of a massive insertion of renewable energies (PSMRE) within a comprehensive and integrated framework by considering extreme events in present and future climates, complexity of the power grid, realistic socio-economic and climate scenarios.

The Postdoctoral candidate will be hired at CentraleSupélec under a 3 years contract (with a possibility of renewal), and will be directed by Professor Anne Barros and Associate Prof. Adam Abdin. She/he will have the opportunity to build a rich network by interacting with the project's partners at the top organizational and operational levels. She/he will also have opportunities to undergo short stays at partner research institutes and universities in France, including with the partner laboratories (Laboratoire des Sciences du Climat et de l'Environnement – CNRS; UMI Soutenabilite et resilience – UVSQ; G2Elab – Universite Grenoble Alpes; and Institut de mathematiques de Bordeaux – Inria) within the collaboration network of the project.

Research topic and objectives

Modern power systems are expected to become increasingly complex to design and operate due to the growing number of renewable energy sources (RES). Renewable energy generation is, by nature, intermittent and introduces an amount of uncertainty that severely affects the physical responses of the power system, particularly in terms of voltage control and frequency regulation [1]. Moreover, RES integration within the power system requires the introduction of many new power electronic devices, which add to the system's complexity and increase its possible failure modes [2,3]. Combined with unexpected initiating events, these two main features can lead to cascading failure risks, triggering disastrous consequences to the power grid and, most notably, large-scale blackouts [4-7]. The economic and societal consequences to the impacted regions are usually massive, with economic loss measured in the tens of billions of dollars [8].

The main objective of this project is to evaluate and optimize the resilience of power systems in the context of a massive insertion of renewable energies. The project aims to elaborate a comprehensive and integrated set of decision support tools by considering extreme events in present and future climates, the complexity of the power grid, and socio-economic scenarios.

Particularly, the PowerDev project seeks to achieve the following tasks:

1. Simulate, characterize, and analyze the scenario of a blackout in the case of a power system with massive renewable energy (PSMRE), including extreme weather events arising in climate change under present and future projections, realistic electrotechnical and field knowledge, inherent grid complexity including interactions with other critical infrastructures, economics, and societal impact models.
2. Propose a quantitative and systemic framework to optimize the resilience of a PSMRE. Specifically focused on addressing possible remedial solutions to apply in the design and operational phases to maximize the system's resilience against major blackouts.

Postdoctoral position objectives/tasks :

The postdoctoral researcher will primarily focus on task 2 for proposing quantitative and systemic frameworks to optimize the resilience of a PSMRE. She/he will have the following tasks:

- Identify practical preventive actions and recovery strategies for power systems against disruptive events (e.g., predictive maintenance, topological reconfiguration, re-dispatch of generators, and post-disaster scheduling of repair crews).
- Assist in developing modeling and optimization frameworks for planning the optimal operational mitigation and response actions, notably within sequential optimization frameworks such as Markov Decision Processes (MDPs) and solution algorithms such as Dynamic Programming (DP).
- Besides working on the research topic, the postdoctoral researcher will significantly contribute to the scientific management and coordination of the PowerDev project among all partner institutions and assist in the organization of research seminars and workshops.

Your profile

You will work within an interdisciplinary project, at the interface of operations research, electrical engineering, and industrial engineering, for which we expect that:

- You are proactive and highly motivated, having a Ph.D. degree in a quantitative discipline (such as applied mathematics, operations research or electrical engineering) from a recognized university.
- You have a strong background in quantitative modeling (statistics, mathematical programming and optimization, and machine learning) and computer programming.
- Professional command of English (both written and spoken) is mandatory. French is not mandatory, but a plus.
- Affinity for working in an international research environment, intercultural skills and ready to travel, as the appointed researcher should be ready to visit the project partners multiple times during his appointment to foster the collaboration and ensure the project organization.

How to apply?

We look forward to receiving your application with the following documents compressed in **one PDF file** and sending it as an attachment to the contact e-mails below with the title "**[Your name]-PowerDev 2023 PostDoc Application**":

- Curriculum Vitae, max. three pages
- Motivational Letter, max. one page
- List of publications
- Two reference letters with contact details

Please note that the position will start as soon as possible.

Applications and questions regarding the position should be directed to Professor Anne Barros (anne.barros@centralesupelec.fr) and Dr. Adam Abdin (adam.abdin@centralesupelec.fr)

Bibliography

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