Ph.D. position offer: Digital Twin for Ageing Resilient Control of Hydrogen-Based Microgrids

16/06/2023

Keywords

hydrogen energy, electric power system, microgrid, aging, resilient control, digital twin, energy management, renewable energy, energy storage, optimization

Context

Reducing greenhouse gas emissions is a challenge for our planet. We must recourse to the installation of sources of renewable origin, decentralized by nature. The project aims to develop an aging resistant control for a microgrid including different sources and charges in link with energy storage.

The Ph.D. position is part of the ANR project Genial (Gestion d'éNergie d'un mIcro-réseAu à hydrogène résiLient au vieillissement- Stabilisation, résilience, optimisation sur cycle de vie). It is funded for a duration of 42 months.

Scientific Objectives

The focus of the Ph.D. thesis is on the development of an ageing resilient control of a microgrid. The main steps of the thesis will be as follows:

- Review of the related state-of-the-art,
- Collection of the necessary data and modeling of microgrid (digital twin),
- Definition of algorithms to be integrated in the digital twin,
- Adaptation of the algorithms including aging mechanisms in the digital twin,
- Define the control parameters to be adapted in real-time to reduce aging of components,
- Planning and integration of start/stop of components in accordance with the hydrogen microgrid into the digital twin,
- Contribution to experimental validation,
- Writing of the thesis document and defense.

The selected applicant will also be expected to:

- Publish in international journals and conferences,
- Participate in project meetings, in the writing of deliverables as well as in communication and dissemination events,
- Participate in the scientific activities of the respective laboratories and universities.

Expected qualifications

- Master's or 5-year engineering degree in electrical engineering, applied mathematics or a related field,
- Interest for energy issues and research,
- Knowledge in power systems, renewable energy, hydrogen energy, optimization,

- Experience with Python and/or Matlab programming,
- Good level of written and oral English,
- A good level of French is a plus.

Supervision

The selected Ph.D. student will be supervised by:

- Dr. Daniela Chrenko, Associate Professor HDR at UBFC/UTBM and FEMTO-ST,
- Dr. Robin Roche, Associate Professor HDR at UBFC/UTBM and FEMTO-ST,
- Prof. Samir Jemei, Professor at UBFC/uFC and FEMTO-ST,
- Prof. Mickaël Hilairet, Professor at Ecole Centrale de Nantes and LS2N.

Application

Please send a motivation letter, a detailed CV and transcript of results to the following email addresses:

- <u>daniela.chrenko@femto-st.fr</u>
- <u>robin.roche@femto-st.fr</u>
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Additional Information

Location: FEMTO-ST at Belfort, France Dates: october 2023 to september 2026 Financial support: ANR-22-CE05-0026, GENIAL project, https://anr.fr/Projet-ANR-22-CE05-0026 Approximate gross salary: 2044 €/month

About the GENIAL project

GENIAL (Gestion d'éNergie d'un mIcro-réseAu à hydrogène résiLient au vieillissement - Stabilisation, résilience, optimisation sur cycle de vie) is a research project funded by the French Research Agency (ANR) from 2023 to 2026. It focuses on the design of microgrids. They are composed of sources/loads (solar photovoltaic, fuel cell, electrolyser) associated with storage elements (battery, hydrogen tank) to meet this societal challenge. The decentralization of sources and storage elements leads to a complex energy system and requires a control integrating all the knowledge on the aging of the energy system to ensure the stability of the continuous micro-grid (DC), optimal efficiency and compliance with the constraints on the components (current/voltage, state of charge, etc.) during the period of use.

About UBFC and FEMTO-ST

Université Bourgogne Franche-Comté (UBFC) is a community of universities and institutions which gathers seven higher-education and research institutions. UBFC currently hosts more than 60,000 students and 8,800 staff. It spreads across 13 sites in the Bourgogne Franche-Comté region in France.

FEMTO-ST is a joint research unit of several UBFC institutions (Université de Franche-Comté, ENSMM, UTBM) and CNRS, the French national research center. With over 750 researchers and staff, it is a leading institute in the field of engineering sciences. Its Energy department is located in Belfort, France, and hosts the largest French research group in hydrogen energy. FEMTO-ST is a partner of FCLAB, a CNRS unit dedicated to applied hydrogen energy research and transfer. The SHARPAC team of the Energy department has a strong expertise in hydrogen energy systems, and especially in ageing-aware diagnostics and prognostics, and in energy and power management of systems integrating them.

FEMTO-ST also includes a multi-disciplinary humanities team, RECITS, with a focus on technological change.

For more information, see https://www.ubfc.fr/ and https://www.femto-st.fr/.