Master 2 internship

Energy Management of Microgrids Using Artificial Intelligence

Environment

Laboratory : Laboratoire Génie de Production Supervisor : Mohamed KOUKI

Website : https://www.enit.fr/fr/recherche.html

Research group e-ACE² : https://www.lgp.enit.fr/fr/composition-des-equipes-2/departement-scientifique-systemes.html

Application deadline : January 15, 2024 0 :00 am

Keywords

Energy Management, Renewable Energy Sources, Microgrid, Artificial Intelligence, Optimization

General context

Ensuring energy security, environmental sustainability, technology cooperation, and socio-economic development are major priorities for the Energy transition in a context dominated by growing concerns over energy security, climate change, low carbon emissions and development. The global energy demands are growing more rapidly and particularly in the isolated areas (e.g., rural). To deal with this, the integration of renewable energy sources using the microgrid concept will be considered. To guarantee an optimal performance of these microgrids while minimizing the cost, a new smart energy management strategy based on advanced Artificial Intelligence techniques are required. To do so, we aim to collect a homogenous database (economical, environment, and author non-structural data,…), develop microgrid models using the Simscape toolbox of MATLAB (isolated and connected), propose management strategy based on advanced AI techniques.

Expected contribution

The internship can be structured into main complementary activities. These activities consist mainly of:

- Bibliography overview regarding the different structure of the microgrids (isolated and connected).
- Database forming (features are: technical, environmental, economical, Social information…) associated to the different Microgrid operating mode (PV, WIND, Storage systems, Loads). Pre-processing (analyzing, reduction, cleaning…) and preparation of some indices will also be done for this database.
- Implementation of microgrids under MATLAB using Simscape toolbox.
- Development of smart energy management based on advanced AI algorithms.
- Comparison with other energy management tools (mainly the meta-heuristics methods).
- Real time validation of the proposed methodology using dSPACE and/or Nano Jetson card.

Required Skills

The candidate must fit the following requirements:

- ❖ Registered in Master 2 in Electrical Engineering.
- ❖ Good skills in modeling and or control of microgrids.
- ❖ Good skills in Machine/Deep Learning are required.
- ❖ Good skills in Python are mandatory.
- ❖ Good skills in MATLAB (Simscape Toolbox) are mandatory.

The candidate must also have a good English speaking level and qualities of written and oral communication and synthesis in English and in French will be appreciated.

How to apply

All applications must be sent by email (CV + cover letter, optional M1 transcript) at mkouki@enit.fr

At the end of the application phase (end of receipt of applications on January 15, 2024, 0 :00 am), an audition will take place between 16/01 and 23/01.

Internship progress

The internship will last 5 months (6 months possibility). The bonus will be paid monthly and will correspond to the hourly bonus rate of €3.90 per hour of internship. The monthly bonus will be calculated on a pro rata basis of days worked, with the following calculation: 1 day = 7 hours.

The start of the internship is possible from February 2024.

There are two exercise sites located in the same city but approximately 5 km apart :

- Laboratoire Génie de Production (LGP), Ecole Nationale d'Ingénieurs de TARBES, 47 Avenue d'AZEREIX, 65000 TARBES, France.
- Plateforme PRIMES, 67 Boulevard Pierre Renaudet, 65000 Tarbes, France.

References

[1] Kouki, M., Marinescu, B., & Xavier, F. (2020). Exhaustive modal analysis of large-scale interconnected power systems with high power electronics penetration. IEEE Transactions on Power Systems, 35(4), 2759-2768.

[2] Kouki, M., Marinescu, B., & Xavier, F. (2022). Exhaustive modal analysis of large-scale power systems using model order reduction. Electric Power Systems Research, 212, 108541.

[3] El-Sehiemy, R. A. (2022). A novel single/multi-objective frameworks for techno-economic operation in power systems using tunicate swarm optimization technique. Journal of Ambient Intelligence and Humanized Computing, 13(2), 1073-1091.

[4] Alizadeh, A., Kamwa, I., Moeini, A., & Mohseni-Bonab, S. M. (2023). Energy management in microgrids using transactive energy control concept under high penetration of Renewables; A survey and case study. Renewable and Sustainable Energy Reviews, 176, 113161.

[5] Tajjour, S., & Chandel, S. S. (2023). A comprehensive review on sustainable energy management systems for optimal operation of future-generation of solar microgrids. Sustainable Energy Technologies and Assessments, 58, 103377.