School of Computing, Engineering, and the Built Environment
Edinburgh Napier University

PHD STUDENT PROJECT

Funding and application details

Funding status: Self funded students only

Application instructions:
Detailed instructions are available at https://blogs.napier.ac.uk/scebe-research/available-phd-student-projects/

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:

- DIRECTOR OF STUDY: Francisco Vedreño Santos (Email: F.VedrenoSantos@napier.ac.uk)
- 2ND SUPERVISOR: Savvas Papadopoulos

Subject Group: Cyber-security and system engineering

Research Areas: Electrical Engineering

Project Title: Advanced digital signal processing for condition monitoring for rotative electrical machines

Project description:

The production of electric energy from wind technology has experience great advances in the later years. It is estimated that the potential of wind energy in the world is between 20.000 x 106 and 50.000 x 106 MWh/year, whereas the energy consumption is about 15.000 x 106 MWh/year.

According to the International Energy Agency (IEA), a net wind capacity of 40.68 GW was added in 2014 by the IEA Wind member countries 39% more than the capacity added in 2013, with a total installed wind capacity of 314.72 GW. The IEA

estimates that in 2050 12% of electric energy will be produced by the wind energy industry. The global electric car stock surpassed 2 million vehicles in 2016 with a growth of 60% with respect to 2010. It is expected a great increase of Electrical Vehicles (EVs) by 2030. All this data show the importance of the wind energy at the present time, not only form a quantitative aspect, but also since it is a renewable energy, local and clean, that improves the energy independence. Furthermore both the wind energy and the electrical vehicle contribute to climate change mitigation. Problems such as the evaluation of the wind energy potential, location, wind turbines design, topology of the drive, integration of the wind energy in the grid, among others, caught the attention of a huge number of researchers.

This PhD opportunity focuses on the productivity of wind turbines and electrical vehicles by detecting faults at the early stages. Hence the downtimes and maintenance cost are reduced.

The main goal of this PhD is to develop new diagnostic techniques for the early diagnosis of failures in electrical machines fed by variable speed drives. The techniques which are intended to be developed are based on the monitoring of electric and magnetic magnitudes such as line current, electric power, magnetic flux, etc., which are easily accessible, for analysis by adequate signal processing tools.

It is intended to develop diagnostic methods optimised for wind turbines and electrical vehicles. Their working conditions imply that the speed and load regimes are always in transient state. Furthermore, both the wind turbine generators and electrical vehicle motors are fed by variable speed drives. It is also intended that the proposed methodologies can be integrated in the predictive maintenance system of wind farms and in the diagnosis system of electrical vehicles.

References:

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in Electrical Engineering

Subject knowledge:

- Electrical Engineering

Essential attributes:

- Experience of fundamental electrical machines and their control techniques. Competent in use of Matlab, Matlab Simulink and signal processing and analysis.
- Knowledge of electrical machines operation and their modelling, programming scripts in Matlab and practical skills.
- Good written and oral communication skills. Strong motivation, with evidence of independent research skills relevant to the project.
- Good time management.

Desirable attributes:

- Advanced knowledge of induction machines, synchronous machines and DC machines. Knowledge of signal acquisition, processing and analysis.