

Research Studentship

Registered for PhD at Durham University,
based at Rutherford Appleton Laboratory, Oxfordshire

Job Description

An exciting opportunity has arisen to carry out pioneering research in wind energy, working as part of the EPSRC-funded Supergen Wind Energy Technologies project, now entering its second 4-year phase.

An electrical engineer with knowledge of power electronics and grid connections is required to take up a PhD studentship on connection technology and energy storage for large offshore wind farms.

The successful applicant will register for a PhD at University of Durham and would be expected to complete the doctorate during the four year period. The applicant will be registered at Durham University, but will be based primarily with the Energy Research Unit (ERU) at Rutherford Appleton Laboratory in Oxfordshire.

Background and context

Phase 2 of the EPSRC -funded Supergen Wind project has recently started and is expected to run for 4 years. The project is a consortium of ten academic partners covering a wide scope of research activities, with the mission to undertake research to achieve an integrated, cost-effective, reliable & available offshore wind power station. The overall aim is to improve the prospects that a significant share of UK's power generation in the future can be safely placed in such a remote and hostile environment.

In the first two years, the project has three themes: 1) the wind farm, including wind resource, aerodynamics and optimization of performance; 2) the wind turbine, including dynamics, materials, fault detection and foundations; and 3) the wind farm connection, with the key requirements to achieve control performance, reliability, maintainability and cost effectiveness. The work packages for this third theme include performance evaluation, control schemes, connection to shore, and integration of energy storage.

In the final two years, the three themes will merge to address the operation of an offshore wind farm as an integral power station.

Duties and responsibilities

The PhD student will work on wind farm connection studies within Theme 3, and specifically will be responsible for definition of the requirements for integration of energy storage, to enhance steady-state and dynamic performance of the integrated system. Key aspects of the research will involve investigation of requirements for energy storage, considering avoidance of turbine trips during network fault conditions, avoidance of curtailment during over-frequency events, and enhancement of frequency response and stability. The suitability and integration of a range of high power and high energy technologies will be investigated.

Specific developments will include creating Simulink models for three types of energy storage sub-systems, including their control interfaces. The storage models will be incorporated in PSCAD power system models, in collaboration with academic partners within Theme 3.

Simulation of power systems incorporating storage will be conducted to investigate power system performance improvements for a range of network and turbine faults and over-frequency events, and for a range of storage capacity and power ratings. Results will include measurement and optimisation of the storage operational envelopes.

Analysis of the cost and benefit of storage solutions will be completed. Profiles of storage operation from simulation will be used to analyse the expected lifetime of storage. Small-scale experiments on electrochemical storage cells using expected operational profiles obtained by simulation and from wind turbine power measurements will be conducted to support lifetime data from manufacturers.

The student will be expected to develop relationships and interact with the other project partners on a regular basis to ensure successful integration of models, and therefore the ability to work in a team is essential.

Contacts and Communication

The student will be supervised by Professor Peter Tavner in Durham and Dr Alan Ruddell at ERU. Prof Tavner is Professor of New & Renewable Energy in the School of Engineering and Computing Sciences at University of Durham, the Supergen Wind Energy Technologies project manager, and the Theme 3 leader, responsible for strategic direction of the project and for co-ordination of project activities. Dr Alan Ruddell is a Senior Research Engineer in the ERU at Rutherford Appleton Laboratory. The student will also form close working relationships with key researchers at the Universities of Durham, Strathclyde and Manchester, undertaking complementary activities in connection technology within Theme 3.

ERU is part of the Applied Science Division (ASD) in the Technology Department at Rutherford Appleton Laboratory, part of the Science and Technology Facilities Council (STFC).

It is expected that during the project, the student will concisely present the results of his research at project meetings attended by Theme and Consortium members and industrial partners, and will write and present papers at national and international electrical power system and wind energy conferences. Towards the end of the project the student will also be expected to contribute to writing high quality journal papers.

Qualifications, Personal Skills and Attributes

A suitable candidate will have an electrical engineering qualification and experience of electrical power systems and modeling techniques. Ideally the candidate will have experience of using Matlab, Simulink, PSCAD/EMTDC mathematical modeling packages. Training may be given where appropriate.

A suitable candidate will be able to work in a team, be able to communicate clearly orally, in writing, and in presentations. It will also be important to have the ability to think strategically and to be able to provide innovative and structured solutions to problems.

Other Relevant Information

Statement on equal opportunity.

All posts are subject to pre-employment screening.

Job and Person Requirements

Applications should demonstrate by example how you meet the requirements. Any other information, which you feel is relevant to your application, may also be included.

Qualifications

Essential:

Electrical Engineering degree (or similar), preferably at 1 or 2.1 level.

Mathematics (and preferably Further Mathematics) A level or equivalent, preferably grade B or higher.

English GCSE or equivalent, preferably grade B or higher.

Knowledge and Experience

Essential:

Excellent mathematical skills.

Experience of power systems and power electronics.

Knowledge of computer modelling and structured programming.

Desirable:

Experience of Matlab, Simulink, PSCAD/EMTDC

Knowledge of electrical energy storage technologies

Knowledge, experience, and interest in renewable energy.

Personal Skills and Qualities

Essential:

Ability to work as a member of a team.

Clear oral and written communication.

Good Presentation skills.

Ability to think strategically.

Problem solving ability.