EngD/PhD Studentship: Data-Driven Digital Twins for Measured Energy Systems

Institution: The University of Manchester (UoM)
Partners: National Physical Laboratory (www.npl.co.uk) and Manchester Simulations Ltd (www.mansim.com)
Project type: Collaborative EngD/PhD
Duration: Approx. 3.5 years
Location: Manchester, with an extended placement at NPL (at least 6 months) and Mansim (at least 6 months)
Start date: Sep/Oct 2026

Project overview
Modern low-carbon energy systems such as photovoltaic (PV) arrays and battery energy storage systems (BESS) generate extensive measurement data (electrical, thermal, imaging and diagnostic). However, there is currently no generic, metrology-grounded AI/ML framework that fuses these heterogeneous data with physics-based models to create trustworthy, asset-specific digital twins with quantified uncertainty.

This project which will be in close collaboration with National Physical Laboratory (www.npl.co.uk) and Manchester Simulations Limited (www.mansim.com), will develop a measurement-science-driven digital twin framework for energy assets, initially demonstrated on PV modules/fields and battery systems using existing NPL datasets. The work will integrate suitable physics-based models (for example PV performance modelling, electro-thermal and thermofluid dynamics) with deep learning and multi-fidelity modelling. Bayesian fusion/inference methods will also be integrated for state estimation, uncertainty quantification, anomaly detection, remaining-life prediction and operational optimisation.

Research aims and indicative work packages
- Develop a generalizable, multisensory digital twin methodology for PV and battery systems that is metrology-guided and uncertainty-aware.
- Create Bayesian data fusion and uncertainty quantification approaches that deliver traceable confidence intervals for model outputs to aid decision making.
- Validate the framework using calibrated datasets (including ageing, diagnostic, thermal and electrical performance measurements).
- Demonstrate asset health assessment capabilities including anomaly detection and remaining-life prediction with quantified uncertainty.
- Align outputs with emerging best practice in digital metrology for energy systems and support dissemination through stakeholder engagement routes.

Training environment and collaboration
- Mansim (www.mansim.com) will provide industrial supervision, training and access to commercial CFD/AI platforms and representative industrial case studies, supporting rapid translation of outcomes into practice.

- NPL (www.npl.co.uk) will provide the measurement-science foundation, calibrated datasets, specialist support in data science and uncertainty, and host the student for an extended placement with facilities and training.

Candidate profile

Essential:

- Degree in engineering, physical sciences, computer science, or a closely related discipline (typically first-class or high 2:1, or equivalent; Master's welcome)
- Strong programming skills (for example Python, MATLAB, C/C++)
- Strength in at least two of: machine/deep learning, numerical modelling, statistics, optimisation, scientific computing
- Ability to work across disciplines and collaborate with academic and industrial teams

Desirable:

- Experience in Bayesian inference, probabilistic modelling, or uncertainty quantification
- Experience in deep learning for time-series, imagery, and/or multimodal data
- Energy systems knowledge (PV, batteries) or experience with real measurement datasets
- Physics-based simulation, surrogate modelling, or multi-fidelity methods

Funding and eligibility

This is a fully-funded collaborative EngD/PhD studentship.

Funding package and eligibility: This 3.5-year PhD project is fully funded and home students, and EU students with settled status, are eligible to apply. The successful candidate will receive an annual tax-free stipend set at the UKRI rate (£20,780 for 2025/26) and tuition fees will be paid. We expect the stipend to increase each year.

How to apply

Apply online through our website: https://uom.link/pgr-apply-2425

When applying, you'll need to specify the full name of this project, the name of your supervisor, if you already having funding or if you wish to be considered for available funding through the university, details of your previous study, and names and contact details of two referees.

Enquiries

Project enquiries (supervisory team):

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