THE UNIVERSITY OF MANCHESTER

PARTICULARS OF APPOINTMENT

FACULTY OF SCIENCE & ENGINEERING

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL, AEROSPACE AND CIVIL ENGINEERING

RESEARCH ASSOCIATE IN WELD MULTI-SCALE MODELLING

VACANCY REF: SAE-025155

Salary:	Grade 6 £36,024 to £44,263 per annum, depending on relevant experience
Hours:	Full time
Duration:	Fixed term from 1st July 2024 for 24 months
Location:	Oxford Road, Manchester

Enquiries about the vacancy, shortlisting and interviews:
Name: Professor Mike Smith
Email: mike.c.smith@manchester.ac.uk

Background

The School of Engineering is one of two large, multi-disciplinary Schools within the Faculty of Science and Engineering, the other being the School of Natural Sciences. The Schools operate alongside the Faculty's research institutes including: Manchester Institute for Biotechnology, Dalton Nuclear Institute and Photon Science Institute, Thomas Ashton Institute and the University of Manchester Aerospace Research Institute (UMARI). The School is made up of four academic departments; Chemical Engineering & Analytical Sciences, Computer Science, Electrical & Electronic Engineering and Mechanical, Aerospace & Civil Engineering.

The School's purpose is to foster an environment and culture where people use curiosity and imagination to create engineering solutions and develop skills that have a positive impact on society and we believe we can't do this without our people.

The School hosts over five thousand undergraduate and postgraduate students across seven academic teaching disciplines including engineering project management. Our interdisciplinary, research spans multiple themes including, robotics, nuclear, bioengineering, modelling, virtual engineering and resilient systems and is enabled by our world-class facilities and technical support. Social responsibility is at the centre of everything we do within the School whether that

is our teaching and learning incorporating the UNs sustainable development goals, our research addressing societal grand challenges such as plastic usage, climate change or the ageing population as well as our commitment to supporting our students, staff and communities.

The School has initiatives to enhance the working environment of all staff including; staff engagement lunches, focused support groups, away days, wellbeing activities, training and development opportunities, mentoring, flexible working, social spaces, seminars, and volunteering opportunities.

The School welcomes applications from all sections of the community and are committed to having a representative workforce. Across the School we hold Bronze and Silver Athena SWAN Awards, which recognises our commitment to equality, diversity and inclusion and particularly the advancement of women's careers in STEM. Videos and information on this can be found at https://www.mace.manchester.ac.uk/about/women/ and https://www.cs.manchester.ac.uk/about/women/

The Department of MACE is the largest Department within the Faculty of Science and Engineering at the University of Manchester. Manchester was the birthplace of the engineering discipline, and MACE has its roots in the Institute of Mechanics founded in 1824. Today the Department hosts over 1300 undergraduate and 450 postgraduate students, delivers undergraduate programmes across Mechanical, Aerospace and Civil Engineering, and MSc programmes across four Disciplines of Education: Mechanical Engineering, Aerospace Engineering, Civil Engineering and Engineering Project Management. With 130 academic staff, 100 technical and administrative staff, and 300 postgraduate researchers, the Department is at the forefront of engineering education in the UK. More information about the Department can be found at: https://www.mace.manchester.ac.uk/

SINDRI (Synergistic utilisation of INformatics and Data centRic Integrity engineering) is a five year, ~£6M, EPSRC Prosperity Partnership between EDF and the Universities of Bristol, Manchester, and Imperial College. It started in May 2021, and is expected to be completed in mid-2026

Its vision is to reduce the cost of nuclear power generation through changes in the processes related to design, fabrication, and life-time assessment. SINDRI is exploiting the opportunity of digitally enabled materials to accelerate the implementation of novel designs, fabrication methods, and structural performance assessments. It will take advantage of new materials modelling frameworks and high-fidelity validation experiments to replace existing manual design and assessment processes with a virtual environment that uses open-source, inter-connected, multi-physics, modular models. These offer the opportunity of integration into EDF's Federated Digital Twin.

At Manchester, we are applying a combination of mechanism and length-scale appropriate modelling techniques and advanced materials characterisation to develop validated virtual descriptions of the entry into service state of weldments. These are then being utilized by other partners both to develop sub-continuum descriptions of structural and materials degradation, and to develop reduced, engineering models of the same processes for integration into EDF's digital environment.

MANCHESTER 1824
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Overall Purpose of the Job

The successful applicant will extend and apply the weld modelling activities for which Manchester are responsible. In particular:
(1) they will pick up the modelling framework developed for electron beam welding of SA508 GR 3 EB welds in previous projects, and already extended in SINDRI to multi-pass welds with weld filler, and apply it to large scale real-world weld geometries. They will also develop methods for efficient computation of these large structures;
(2) they will work closely with the relevant project investigators in the application of multi-component CFD, phase field, and cellular automata approaches to weldment modelleing;
(3) They will work closely with other project staff at Manchester in the development and application of advanced materials characterisation techniques used to validate the modelling framework;
(4) They will work closely with project staff responsible for application of machine learning and artificial intelligence techniques weld structural performance prediction.
(5) They will take part in project technical and management meetings, and disseminate their results to project partners.
(6) They will liaise closely with industry collaborators from EDF Energy to facilitate take up of new modelling techniques in industry
(7) They will also perform any necessary software development in a controlled and fully documented fashion, so the software may be readily and reliably used by others.

Person Specification

Essential Knowledge, Skills, Experience and Qualifications

Specialist knowledge and experience in a significant portion of the following areas:

- Sub-continuum modelling techniques for describing materials and structural performance
- Complex applications of the finite element method using ABAQUS (preferably) or equivalent codes, for example:
    - Development of ABAQUS User subroutines
    - Weld Residual stress and Distortion prediction using finite element methods.
    - Application of local approaches to fracture
- Experience in addressing the problems of validation of both continuum and sub-continuum models of materials and structural performance
- Proven ability in record-keeping and documentation in large projects

General skills

- Good communication and interpersonal skills
- Experience of working in multi-disciplinary teams
- Ability to liaise effectively with external organisations and industrial partners