

THE UNIVERSITY OF MANCHESTER
PARTICULARS OF APPOINTMENT
FACULTY OF SCIENCE & ENGINEERING
SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL, AEROSPACE AND CIVIL ENGINEERING
RESEARCH ASSOCIATE IN COMPUTATIONAL FLUID DYNAMICS
VACANCY REF: SAE-027887

Salary: Grade 6 £36,924 to £45,163 per annum, depending on relevant experience

Hours: Full time (1 FTE)

Duration: Fixed term for 30 months

Location: Oxford Road, Manchester

Enquiries about the vacancy, shortlisting and interviews:

Name: Prof Alistair Revell

Email: Alistair.revell@manchester.ac.uk

Background

This post is associated with a large collaborative project, Unity, between The University of Manchester, Cummins Ltd., and Holtex Ltd. The project is funded by Innovate UK and led by Cummins, a world leader in power technologies manufacturing diesel and alternative fuel engines and generators. The aim is to develop a digital tool for the design of key products in Hydrogen fuelled powertrains, enabling the prediction and mitigation of component failure when exposed to hydrogen environments. Project Unity targets digitalisation to unlock innovative product manufacturing, and de-risking by reducing likelihood of costly rework. Critical components used in hydrogen powertrain applications, including turbine, compressor and bearings, will be tested by the participating companies to provide real data for the failure mode simulations. The University of Manchester is tasked with the development and validation of a cutting-edge digital tool to aid rapid, accurate and efficient product design, by integrating fluid and solid mechanics modelling and simulation.

Overall Purpose of the Job

The postholder will be working on fatigue and wear modelling in hydrogen powertrains, focusing on the key failure modes such as hydrogen effects, water droplet erosion and thermomechanical fatigue. They are expected to apply their expertise with creativity and imagination to a develop digital twin of one or more of these effects, employing suitable levels of approximation, and to validate them by comparison of simulation results with experimental data. This postholder will

focus their attention on either or both of the turbine housing and the turbine wheel; with operating conditions relevant to either an internal combustion engine or a fuel cell configuration. The simulations will focus on prediction of the turbulent flow and conjugate heat transfer and, in the case of the fuel cell, will also consider assessment of risk erosion due to water droplets. The bulk of the work will be undertaken on open-source CFD codes such as Code_Saturne and OpenFOAM. A one-way coupling to a structural mechanics solver is required, to link to work undertaken by a second PDRA on this project. A two-level multiscale approach will also be employed, to explore impact on performance of damage leading to surface roughness, using material properties and images obtained from other colleagues in this project. Aside from the aim to achieve a high level of working accuracy, the postholder will explore and document the impact of a range of different fidelity approaches in the context of what is known as 'hierarchical multi-fidelity modelling'.

The postholder will be working alongside and in collaboration with a second research associate working on detailed solid mechanics and material modelling of fatigue and wear, which will provide important thermal and mechanical properties as input to the computational fluid dynamics work. A Technical Specialist will also be appointed to support the development of the digital platform. The team approach will enable complex challenges to be addressed in a holistic manner.

The postholder is expected to produce impactful demonstrations of the capability of the new assessment tool and to communicate these effectively to all project partners both in written and oral form as required. They are also expected to produce journal articles and conference presentations to maximise the impact of the work on both the academic and wider industrial communities. Strong impact is expected in several industries which are working on a transition to hydrogen economy.

The postholder will join the Department of Mechanical and Aerospace Engineering and is expected to collaborate and support team members within their area of expertise when required.

Key Responsibilities, Accountabilities or Duties

The postholder will be directly responsible for the delivery of the tasks outlined in the purpose of the job and will report to Prof Revell. The range of duties will include:

- Ensure intellectual rigour and adherence to ethical standards in the work for which they are responsible
- Contribute to community activities of the immediate research group environment
- Translate knowledge of advances in their subject area into research activity
- Use initiative and creativity to identify areas for research, develop new research methods and extend the research portfolio
- Plan and manage own research activity in collaboration with others
- Help colleagues to interpret data, to manage competing priorities, and to develop their research skills
- Communicate material of a specialist or highly technical nature to members of the team and the industrial partners
- Contribute to collaborative decision making with colleagues in other areas of research

- Produce publications of international quality in the quantity appropriate to the discipline
- Play a major part in the successful dissemination of their and the team's research findings, presenting at conferences and contributing substantially to publications
- Contribute effectively to the development of activities to achieve engagement with research, and/or impact beyond academia
- Build internal contacts and participate in internal networks for the exchange of information and to form relationships for future collaboration
- Attend and contribute to relevant meetings of the group and with industry

Post holders are required to familiarise themselves with the University's Equality and Diversity policies and to actively support these wherever possible.

Person Specification

Essential Knowledge, Skills, Experience and Qualifications

- PhD (or equivalent) in Computational Fluid Dynamics in an area relevant to this project
- Specialist knowledge in the domain of turbulent flows and thermal hydraulics
- Extensive experience in Computational Fluid Dynamics, ideally of applications relevant to the work in this project, and ideally involving the use of high-performance computing
- Experience with programming in a major programming language, ideally gained via the development and use of open-source computational fluid dynamics software
- Experience with presenting in both written and oral forms
- Excellent communication and interpersonal skills
- Excellent time management and organisational skills
- Flexible approach to dealing with research problems as they arise
- Ability to work independently and as part of a team
- Ability to liaise confidently and effectively with a range of individuals
- Ability to meet deadlines