University of Nottingham
UK | CHINA | MALAYSIA

Role profile

Job title	Research Associate/Fellow in Friction Welding Analysis and Characterisation	Job family and level	Research and Teaching Level 4 (Appointment will be Level 4 Career training grade where an appointment is made before PhD has been completed)
School/ Department	Faculty of Engineering, G2TRC	Location	Jubilee Campus, RAD Building

Purpose of role

The Gas Turbine Transmission Research Centre (G2TRC) welcomes applications for a part time (approximately 50% FTE) post-doctoral researcher to work in the multi-university, industry supported project. Friction welding is an essential manufacturing technology. There is a great industrial demand to enhance understanding of material behaviours under loading conditions that are representative of the process and develop predictive tools which simulate the complex thermo-mechanical interactions seen at the weld interface. The high temperatures, temperature rates, and strain rates seen in inertia and linear friction welds makes flow stress characterisation particularly challenging. The localised nature of the deformation and the potential for uncertainty over conditions at the boundary of the weld region (resulting from, for example, machine and tooling compliance and dynamics) compounds the challenge of simulating the process.

The successful candidate will contribute to the development of this understanding by working closely with Rolls-Royce and using real production process data on a large project. Numerous academic institutions are involved in the project, and the successful applicant will work across a diverse set of research areas as part of an established team. Dynamic machine models will be established to enable local boundary conditions at the weld interface to be determined from routinely collected machine data, with machine learning techniques implemented to alleviate computational costs in “real time” assessment. In addition, flow stresses and damage accumulation rates will be experimentally investigated using novel testing methods and microstructural underpinnings will be determined using advanced imaging techniques like X-ray diffraction. Through collaboration with researchers at Nottingham, industrial sponsors, and other academic partners, the successful applicant will contribute to research at the cutting edge of the field and will develop a wide range of transferable analysis skills. The role holder will report to the principal investigator of the project as their line manager.

	Main responsibilities (Primary accountabilities and responsibilities expected to fulfil the role)	**% time per year**
1	**Contribute to the development of machine models which simulate the dynamic characteristics of inertia and linear friction welding machines.** ▪ The successful applicant will be required to contribute to measurement activities at a Rolls-Royce facility that will furnish the team with dynamic data for friction welding machine characterization. ▪ They will also be required to process the above data and calibrate mass, stiffness, and damping characteristics for the friction welding machines.	75%

	▪ They will be required to develop collaboratively a predictive model of the friction welding machines and, using routinely collected machine data, determine representative near weld conditions (supported by confidence bounds and uncertainty levels). **Contribute to experimental activities that will allow for flow stress and damage characterisation in industry applicable materials (nickel and titanium alloys) under inertia/linear friction welding representative conditions.** ▪ Assist in the design of novel test coupons and methodologies that enable the high heating/loading rates seen in friction welding to be replicated using standard laboratory equipment. ▪ Contribute to the successful completion of testing programs at Nottingham and at a suitable XRD facility. ▪ Process material testing data (at both macro- and micro-scales) and, working with researchers from other universities, validate micromechanical material models for the industry relevant alloys.	
2	**Stakeholders Liaison** ▪ The role holder will have to make regular reports to industrial and academic partners. ▪ They will be responsible for monitoring and communicating project milestones/deliverables. ▪ They will also be expected to explain their work to co-workers within the G2TRC and occasionally to parties from close collaborators in research groups in other Universities.	10%
3	**Documentation and Reporting** ▪ The role holder will be responsible for ensuring that their work is thoroughly documented such that other researchers can advance this work either simultaneously or subsequently. This applies to any computer programming done as well as design calculations and development of research papers. ▪ They will attend meetings with colleagues and stakeholders, both within the university and with industrial partners. ▪ They will be required to produce written reports on their work. The individual will need to make these reports professionally written in English and easy to read without extra support.	10%
4	**Other** ▪ Researchers within the G2TRC are expected to contribute to internal seminar and training activities, by attending and, where appropriate, presenting. ▪ The role holder will be asked to ensure that they undertake regular continued professional development. ▪ Any other duties as appropriate to this post as requested by the line manager.	5%

Person specification

	Essential	Desirable
Skills	▪ Ability to work independently and proactively manage workload whilst highlighting issues and giving potential solutions. ▪ Able to present complex data using different methods (written, oral, etc.) clearly to a wide audience to show analysis and outcomes. ▪ Experience in technical report writing and presentation skills for a specialist audience, and able to collaborate productively with others. ▪ Ability to attend and present at industrial partner meetings with a minimum of supervision.	▪ Project management skills ▪ Good documentation practice for all work, especially relating to computer coding.
Knowledge and experience	▪ Good understanding of deformation mechanisms in metallic materials across a range of loading conditions appropriate to the friction welding processes. ▪ Ability to use programming software (particularly Matlab and Python languages) for the modelling and analysis of engineering systems and components. ▪ Demonstrable experience in the utilisation of machine learning in an engineering context. ▪ Has significant experience in solving engineering numerical problems using finite element approaches. ▪ A fundamental knowledge of the experimental methods used for mechanical characterisation of materials and systems. ▪ Experience in the design of mechanical test fixtures and the generation of high-quality engineering drawings. ▪ Experience in having developed and/or adhered to strict safety systems.	▪ Experience with friction welding processes and an appreciation of the complications/nuances associated with them. ▪ An understanding of uncertainty quantification methods that can be applied in an engineering context. ▪ Practical experience in mechanical testing for dynamic characterisation. ▪ Significant experience in solving engineering numerical problems using finite element approaches. ▪ Practical experience in mechanical testing for material characterisation at elevated temperatures. ▪ An appreciation of (or practical experience with) X-ray diffraction imaging methods.

Qualifications, certification and training (relevant to role)	▪ An honours degree in mechanical engineering or similar. ▪ Holds or is studying toward a PhD in Mechanical Engineering or a related discipline, ideally in a field closely related to mechanical testing and characterisation or mechanical system evaluation.	

The University of Nottingham is focused on embedding equality, diversity and inclusion in all that we do. As part of this, we welcome a diverse population to join our work force and therefore encourage applicants from all communities, particularly those with protected characteristics under the Equality Act 2010.

Expectations and behaviours

The University has developed a clear set of core expectations and behaviours that our people should be demonstrating in their work, and as ambassadors of the University's strategy, vision and values. The following are essential to the role:

Valuing people	Is always equitable and fair and works with integrity. Proactively looks for ways to develop the team and is comfortable providing clarity by explaining the rationale behind decisions.
Taking ownership	Is highly self-aware, looking for ways to improve, both taking on board and offering constructive feedback. Inspires others to take accountability for their own areas.
Forward thinking	Driven to question the status quo and explore new ideas, supporting the team to "lead the way" in terms of know-how and learning.
Professional pride	Sets the bar high with quality systems and control measures in place. Demands high standards of others identifying and addressing any gaps to enhance the overall performance.
Always inclusive	Ensures accessibility to the wider community, actively encouraging inclusion and seeking to involve others. Ensures others always consider the wider context when sharing information making full use of networks and connections.

Key relationships with others

Line manager

Role holder

Key stakeholder relationships