

Post-Doctoral Research Associate in Circular Robotic Manufacturing

Job Ref: REQ250214

As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.

There is a vacancy within the Centre for Sustainable Manufacturing and Recycling Technologies (SMART) at Loughborough University for a talented and enthusiastic new Post-Doctoral Research Associate with strong interest in robotic manufacturing, circular economy, industrial sustainability, remanufacturing and recycling, and a background in mechanical, manufacturing, electronic, and robotic control engineering.

Loughborough University is renowned for the relevance of its research. Research undertaken at Loughborough helps business and industry to compete more effectively, shape public policy and ultimately improve the quality of people's lives. Loughborough has a research community made up of more than 2,200 staff and students, and is well known for having a wide range of research partnerships with multi-national businesses and has long-standing collaborative links with many public and private sector organisations.

The Centre for SMART was first established within the Wolfson School of Mechanical, Electrical and Manufacturing Engineering in 2004. The Centre's mission is to develop the new strategies, methodologies and supportive technologies required to implement a sustainable approach to the design, production, consumption and disposal of manufactured products thereby helping to safeguard the future of the planet. As one of the largest engineering schools in the UK, the Wolfson School is a leader in technological research and innovation, with extensive national and international connections to industry and has benefited from a recent £70 million investment into the west side of campus.

The Centre has core expertise and knowledge in life cycle analysis, sustainable design, resource and energy efficient manufacturing, end of life processing of products, and sustainable consumption and business models that are key enablers for achieving transformational change. Our industrially focused research enables us to work with some of the world's most renowned engineering and commercial companies.

Project Description

The UK is embarking on an ambitious plan to further robotise its renowned manufacturing sector. According to the International Federation of Robotics, there were an average of 101 industrial robots (IRs) per 10,000 employees in operation in the UK in 2020, while the 'industrial robots' market is predicted to grow at a compound annual growth rate of over 40% per annum between 2025 and 2030. This rapid increase in application could, without a strategic deployment, result in many decommissioned robots which together with their controllers and associated digital equipment (e.g. sensors, vision systems, etc.) often contain a large amount of critical raw material (CRM). At present, preventive maintenance is conducted to increase the longevity of IRs typically through pre-scheduled manual checks, visual inspections, equipment testing, and adherence to standard operating procedures which are not customised to specific requirements of different IR applications. The shortcomings of this approach include potential over-maintenance, reduced productivity, high costs, and the possibility of missing non-obvious faults. In addition, due to uncertainties (lack of trusted monitoring data) during use stage, the EoL management involves costly refurbishment to enable a secondary use cycle (often by a different end-user) and/or downcycling of CRM due to adoption of inappropriate material recycling processes. This highlights the urgent need for novel digitally enabled solutions to support a proactive, real-time data-driven lifecycle maintenance of IRs to extend the useful life as well as intelligent decision making at EoL stage to achieve an optimum balance between cost-efficiency, optimal equipment performance, and environmental sustainability. The proposed research aims to tackle both present and looming challenges arising from the environmental impacts of industrial robots, as one of the most widely employed class of digital manufacturing technologies across diverse sectors including automotive, aeronautical, food, and healthcare.

This Engineering Physical Science Research Council (EPSRC) funded research is a collaborative project involving the Centre for SMART, the School of Design in Royal College of Art, Centre for Robotics Research in Kings Collage London, Department of Computer Science in University College London, Manufacturing Technology Centre in Coventry and 8 industrial partners representing manufacturers and users of industrial robots. The overall project aim is to investigate digital solutions to promote a circular use of traditional/collaborative industrial robots (IR) in manufacturing lines by extending the useful life as well as enabling their end-of-life (EoL) remanufacturing and recycling of embedded strategically critical materials.

The major research challenges are: to extend the operational lifespan of IRs, minimising the necessity for costly repairs or replacements, and promote effective remanufacturing and/or circular use of embedded CRM, thus significantly cutting embedded CO2 emissions in producing new robots.

The project is led by Prof Shahin Rahimifard.

Job Description

Job Grade: Specialist and Supporting Academic Grade 6

Job Purpose:

The Postdoctoral Research Associate will work as part of the wider research programme to design and implement a digitally enabled real-time system for extending the life of industrial robots during the use stage as well as developing new circular design guidelines to promote end-of-life remanufacturing and recycling of embedded strategically critical materials. This includes AI-based vision recognition, design of sensory devices, and novel algorithms for machine learning and big data analysis to support disassembly, refurbishment and remanufacturing on industrial robots within range of industrial sectors, including automotive, aeronautical, food, and healthcare. The Research Associate is also expected to take lead in engaging with key stakeholders across the value chain of IRs and development of research proposals for future expansion and continuation of this research.

Job Duties

Research

- To conduct a programme of physical disassembly experimentations to identify the main failure points of robots within a range of industrial settings.
- To design and implement a digitally enabled real-time system for extending the life of industrial robots during the use stage.
- To develop a decision support model based on life cycle sustainability assessment to identify most appropriate reprocessing options for IRs.
- To develop bespoke sensory devices and associated machine learning algorithm to collate and analyse real-time to support refurbishment and remanufacturing of IRs
- To develop guidelines for a 'design for circular economy' approach to improve the remanufacturing, reuse and/or material recycling of IRs.
- To collate, analyse, synthesise, interpret and present research data related to various experimentation programmes.
- To liaise with academic and industrial project partners, and coordinate activities across the consortium.

General, technical

- To perform risk assessments, develop method statements and implement safe working practices.
- To manage technical equipment and provide training to other users as required.
- To actively engage with industrial and other non-academic stakeholders to determine system requirements and identify and address potential barriers for implementation.
- To regularly report research progress to the programme management group through formal and informal reports and communications.
- To write research papers suitable for publication in high quality academic journals and for presentation at specialist scientific conferences.
- To supervise student projects in related areas.
- To attend and contribute to project meetings and engagement events.
- To lead in the development of research proposals and grant applications for follow-on project funding.
- To undertake general lab organisation and coordination tasks

General and administrative

- To work effectively with relevant administrative, technical and academic staff in the School and across the University.
- To engage in training programmes in the University (e.g. through Staff Development) which are consistent with the RA's ongoing professional development, and the needs and aspirations of the project team and those of the School.
- To maintain confidentiality where relevant at all times and ensure that intellectual property agreements are not violated.
- To assist the academic staff in the project team with the supervision of undergraduate MSc and PhD project work and day-to-day supervision and support of other researchers.
- To support Sustainable Engineering teaching delivery as required.
- To carry out specific other duties as may be reasonably requested by the project leaders and that are commensurate with the nature and grade of the post.

Points To Note

The purpose of this job description is to indicate the general level of duties and responsibility of the post. The detailed duties may vary from time to time without changing the general character or level of responsibility entailed.

Special Conditions

All staff have a statutory responsibility to take reasonable care of themselves, others and the environment and to prevent harm by their acts or omissions. All staff are therefore required to adhere to the University's Health, Safety and Environmental Policy & Procedures.

All staff should hold a duty and commitment to observing the University's Equity & Diversity policy and procedures

at all times. Duties must be carried out in accordance with relevant Equity & Diversity legislation and University policies/procedures.

Successful completion of probation will be dependent on attendance at the University's mandatory courses which include Belonging and Inclusion and, where appropriate, Recruitment and Selection.

Organisational Responsibility

Reports to Prof Shahin Rahimifard, Wolfson School of Mechanical, Electrical, and Manufacturing Engineering.

Person Specification

Your application will be reviewed against the essential and desirable criteria listed below. Applicants are strongly advised to explicitly state and evidence how they meet each of the essential (and desirable) criteria in their application. Stages of assessment are as follows:

- 1 Application
- 2 Test/Assessment Centre/Presentation
- 3 Interview

Essential Criteria

Area	Criteria	Stage
Experience	Experience in the fields of AI-based vision systems and robotic programming and control	1,2,3
	Experience in robot control and programming, algorithms for machine learning and big data analysis	1,2,3
	Experience in the fields of manufacturing, remanufacturing and recycling technologies and automation processes	1,2,3
	Experience in developing circular and modular design guidelines and use of computer-aided design systems, preferably to support IR design	1,2,3
	Relevant experience in an academic research environment or equivalent industrial experience.	1,3
	Experience of generating high quality project reports and a record of academic and industrial publications or other forms of research outputs.	1,3
	Experience of presenting research findings at all levels, adapted to specific audience needs, ranging from academic experts to general public	1,3
Skills and abilities	Ability to coordinate project activities, manage project tasks, prioritise and meet deadlines	1,3
	Ability to work independently and also as part of a team	1,3
	Willing to work across Schools and universities to maximize cross-disciplinary outputs	1,3
	Excellent written and oral communication skills	1,3
	Excellent interpersonal, and organisational skills	1,3
	Ability to network with other academics and engage with project stakeholders	1,3
	Ability to write project reports and make technical presentations to industrial and academic research groups	1,3
	Skills in finding information in the scientific literature and proposing original ideas	1,3
	Knowledge, awareness and practice of relevant Health & Safety issues	1,3
	Willingness to assist in preparation for meetings	1,3
	Training	A willingness to undertake further training as appropriate and to adopt new procedures as and when required
Qualifications	Have or soon to have a PhD in Mechanical, Manufacturing, Electronic or Robot Control Engineering.	1
Other	Commitment to observing the University's Equal Opportunities policy at all times.	1,3
	Commitment to maintain confidentiality, where relevant, at all times	1,3
	Ability and willingness to travel to national and international partners, and do 1-3 week(s) secondment to project partners	1,3

Desirable Criteria

Area	Criteria	Stage
Experience	Experience in writing research proposals for funding from internal/external sources.	1,3
	Knowledge of relevant environmental standards, in particular ISO14000 family of standards	1,3
	Experience in use of intelligent systems, AI Models, big data analytics and decision support modelling techniques and tools	1,3
	Experience of using MATLAB, Python, and/or LCA modelling software and tools	1,3
	Knowledge of process design and system engineering	1,3
	Knowledge of a whole system view of industrial sectors, including automotive, aeronautical, food, and healthcare	1,3
	Experience in supervising junior members (e.g. PhD or final year project students)	1,3
Skills and abilities	Willingness to work collaboratively with project partners in different locations	1,3

Conditions of Service

The position is FULL TIME and FIXED TERM for a period of 12 months. Salary will be on Specialist and Supporting Academic Research, Grade 6, Salary Band £35,116 -£45,413 per annum, at a starting salary to be confirmed on offer of appointment. The appointment will be subject to the University's Terms and Conditions of Employment for STAFF GRADES 6 AND ABOVE, details of which can be found [here](#).

The University is committed to enabling staff to maintain a healthy work-home balance, however the nature of roles and responsibilities for this post is not compatible with remote and/or working from home.

The University offers a wide range of employee benefits which can be found [here](#).

We also offer an on-campus nursery with subsidised places, subsidised places at local holiday clubs and a childcare voucher scheme (further details are available at: <http://www.lboro.ac.uk/services/hr/az/childcare-information---page.html>)

In addition, the University is supportive, wherever possible, of flexible working arrangements. We also strive to create a culture that supports Equity and celebrates diversity throughout the campus. The University holds a Bronze Athena SWAN award which recognises the importance of support for women at all stages of their academic career. For further information on Athena SWAN see <http://www.lboro.ac.uk/services/hr/athena-swan/>