Wolfson School of Mechanical, Electrical and Manufacturing Engineering

Loughborough University

Research Associate in Dual Mode MEMS Sensing for Propulsion Applications (Marie Curie PhD Fellow)

DIAMOND Marie Curie EU Project

Job Ref: REQ260238

Project Description

DIAMOND (Decentralized critical Infrastructure Asset Monitoring and coNDition assessment) is an EU-funded MSCA Doctoral Network that brings together leading researchers in sensor technology, data communication hardware/software, instrumentation & measurement strategies, structural health monitoring, system identification and data analytics promoting bespoke and timely interdisciplinary dialogue while promoting ethics, responsibility and environmental & societal good. Via training-through-research projects, 16 Doctoral Fellows will be central to the digital transformation in EU for safety, economic competitiveness and resilience of critical infrastructure assets (https://cordis.europa.eu/project/id/101227338) by assimilating sensors, data analytics and sectoral needs of monitoring and assessment for timely decision making. The successful candidate will be funded for 36 months and will be required to complete a PhD programme in that time.

Job Description

Job Family and Grade: Other Academic Related Grade 6

Job Purpose

Low-power Micro Electro-Mechanical Systems (MEMS) are used in pressure, mass/air flow, temperature, speed and position sensors in automotive systems, allowing for tire pressure monitoring, control strategies, engine management and vehicle stability/passenger safety. However, they have not been implemented in unreachable propulsion rotating parts, where transient torque and occurring motions are of great interest. This PhD project will develop novel dual-mode MEMS sensors for a new generation of autonomous (self-powered) sensing for condition monitoring in propulsion applications with implementation in hard to reach, generally inaccessible locations (e.g. powertrain). It will address the dearth of versatile MEMS sensors with the potential to track transient torque and motion using mechanical oscillations in rotary systems.

The expected results of the project are:

1. **Overall:** Fundamental insights & solutions for designing autonomous MEMS for propulsion systems.
2. **R1.** Developing a new, low-power, versatile MEMS scalable sensor to measure dynamic torque from powertrain inaccessible locations using nonlinear dynamics.
3. **R2.** Sensor calibration for motion measurement with ~μs time response, improving ~ms commercial solutions, and capturing transient powertrain events (~kHz).
4. **R3.** Adaptation of the MEMS sensor for autonomous powertrain installation, opening avenues in propulsion applications, addressing lack of solutions and maximizing unique optimisations that are possible with integrated MEMS and vibration energy harvesting.

Job Duties

- To undertake a robust literature review to gain the context of the study area
- To model and design a novel versatile MEMS sensor measuring dynamic torque and motion for automotive powertrains, via nonlinear dynamics accounting for variations in powertrain operating conditions.
- To supervise and schedule the fabrication of MEMS sensor into a device adapted to different powertrain configurations (electric/hybrid) including appropriate electrical circuits with a view to be adopted in autonomous (self-powered) sensing including power management, energy storage, data collection/storage and wireless transmission.
- To test and validate the developed MEMS system (including circuit) in lab setting via a powertrain rig with operating conditions similar to automotive propulsion.
- To package the MEMS sensor device with a view to be used with an existing rotational vibration energy harvester or an alternative stream of power for autonomous sensing.
- To manage the additional requirements of the wider DIAMOND programme including placements, learning and Fellowship collaborations
- To complete the requirements of a UK PhD across all stages of the process.
- Be responsible for conducting the day to day running of their own PhD project.
- To formulate detailed plans for the project based on broad guidance from the project team.
- To feed back to the project team on progress, to make recommendations for next steps.
- Write up regular progress reports and present outcomes as required by the PhD process and the DIAMOND group.
- Travel to attend meetings and make presentations both within the project partners working group and to DIAMOND group.
- To support the project team by enhancing relationships with existing collaborators, the wider DIAMOND group and by assisting the establishment of relationships with new collaborators where required.
- To write research papers suitable for publication in high quality academic journals.
- To attend and contribute to the wider PhD EU network.
- Maintain confidentiality at all times and ensure that intellectual property (IPR) 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-today supervision and support of other researchers.
- Where appropriate, to deliver teaching, tutorial and laboratory sessions to students.
- Engage in training programmes in the University (and the EU group) that are consistent with the needs and
    - aspirations of the project and those of the School.
- Undertake other duties as may be reasonably requested 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 outlined in the document.

Organisational Responsibility

Reports to the: PhD Supervisor and Line Manager.

Contributions for Recruited Researchers over 36 months

Living Allowance: €204,558.12
Mobility Allowance: €25,560
Family Allowance: (where relevant) €17,820

This position and related financial contributions is subject to the commencement of the project and agreement signed.

Person Specification

Your application will be assessed based on the essential and desirable criteria listed below.
Applicants are strongly encouraged to explicitly demonstrate how they meet each essential (and desirable) criteria at the application stage. The criteria that you need to demonstrate in your application will be listed as Stage 1 in the table below.

Stages of assessment are as follows:

1 – Criteria measured at Application
2 – Criteria measured at Test/Assessment Centre/Presentation
3 - Criteria measured at Interview

Essential Criteria:

Area	Criteria	Stage
Experience	Background in mechanical vibrations and dynamics	1,3
	Experience of vibration data collection and signal postprocessing	1,3
	Experience of setting up experimental rigs for vibration measurements	1,3
	Authorising original work for academic journal papers, conference papers or technical reports	1,3
Skills and abilities	Good written and oral communication skills	1,3
	Self-motivated with ability to meet deadlines	1,3
	Able to manage time and task effectively to meet project deadline and prioritise workload with minimum supervision	1,3
	Able to build and maintain effective working relationships with academic colleagues, students, and external partners to support collaborative research and communication of findings.	1,3
	Working knowledge of software packages (e.g. Matlab, Comsol)	1,3
	Working knowledge of specific analytical, numerical methods for vibration analysis	1,3
	Ability to write project reports and make technical presentations to industrial and academic research groups	1,3
	Knowledge of relevant Health & Safety issues	1,3
Training	Demonstrate evidence of having undertaken further training	1,3
Qualifications	First degree in Engineering, or Physics, or related subjects	1,3
Other	Uphold and actively contribute to the University's commitment to Equity, Diversity and Inclusion.	3

Desirable Criteria: These are skills, experience and competencies that are additional extras that may be used to narrow the pool down if we receive a high volume of applications all meeting the essential criteria.

Area	Criteria	Stage
Experience	Experience in MEMS sensor design using vibration analysis	1,3
	Developing proposals for funding from external agencies	1,3
	Working in a high-quality academic research environment	1,3
	Experience of teaching and / or supervision of students in relevant areas	1,3

Skills and abilities	Authoring original work for academic journal papers, conference papers or technical reports	1
Qualifications	Degree demonstrating expertise in mems sensor design	1
Other	Travel / able to travel independently as the sponsorship includes international placements	3

Conditions of Service

The appointment will be subject to the University's Terms and Conditions of Employment relevant to the job grade.

The position is FULL TIME and FIXED TERM for a period of 36 months. Salary will be on the spot scale, at a starting salary to be confirmed on offer of appointment.

Shared University Responsibilities

As a member of the Loughborough community, you are expected to:

- Take reasonable care of yourself, others and the environment, and to prevent harm by your acts or omissions. All staff are therefore required to adhere to the University's Health, Safety and Environmental Sustainability Policies & Procedures.
- Support and contribute to the University's commitment to Equity, Diversity, and Inclusion (EDI), while carrying out all duties in a way that respects these principles and upholds the right to free expression. Further information about EDI at Loughborough and our strategic aims is available on our website

Our Purpose, Vision, and Values

Our purpose, Vision and Values underpin all that we do and shape how we work together at Loughborough.

We're proud to promote our values: **Adventurous**, **Collaborative**, **Creative**, **Authentic** and **Responsible**. Our people bring these values to life every day, and they are central to the positive and supportive culture that makes Loughborough unique.

If you join us, you'll be encouraged to bring these values to life in your own work and contribute to the positive, supportive culture that makes Loughborough unique.

Read more about our **vision and values**.

Our Accreditations

We strive to create a culture that supports equality 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.

We are proud to be a Race Equality Charter Member. The Charter aims to improve the representation, progression and success of all minority ethnic staff and students within higher education and address issues of racism within higher education institutions (HEIs).

We are proud to be a Disability Confident Employer and have adopted a proactive approach to employing disabled people and to creating a more diverse workforce. We ensure that our recruitment processes are inclusive and accessible. We guarantee to offer an interview to all applicants who have declared themselves with a disability, provided they meet the essential criteria for a role. We proactively anticipate and provide reasonable adjustments and support existing employees who acquire a disability or long-term condition to thrive in the workplace.

We are a real living wage employer, and our Living Wage Employer Mark shows our commitment to paying our staff according to the cost of living.

We are proud supporters of the City of Sanctuary movement and delighted to be recognised as a University of Sanctuary. This national network brings together, university staff, lecturers, academics and students, who together work to make Higher Education institutions place of safety, solidarity and empowerment for people seeking sanctuary.

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.