Loughborough University

Research Associate in Intelligent Electrification
Job Ref: REQ221183

As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.

Aeronautical and Automotive Engineering

Project Description

The post holder, Post Doc Research Associate (PDRA), will contribute to the exciting research programme of a recently approved EPSRC New Investigator Award (under Grant EP/W027283/1) to Dr Jun Yang. To advance an era of green, clean, and affordable energy, this EPSRC NIA project will develop a novel Modulator-free Performance-Oriented Control (M_fPOC) framework as a paradigm shift of the advanced electric drive control strategy to deliver promising properties like higher control bandwidth, lower current distortion, and lower device switching frequency for electric machines. With these achievable performance specifications, when applying to vehicle electric motors, this new M_fPOC technique will significantly improve the energy conversion efficiency, and provide much higher power/torque density and smoother speed/current/torque regulation performance, which will substantially increase battery life, enable wider range of driving scenarios, and enhance user comfort and vehicle durability by reducing unwanted noise, vibration, and harshness (NVH) of electric vehicles.

The post holder will have an opportunity to join a leading international team working on cutting edge research. They will have opportunities to collaborate with industrial partners. It is expected that the post holder shall have strong analytical skills and be interested in working on challenging theoretical problems in the engineering context. The PDRA will focus on advanced control theory on advanced control and optimisation theory (e.g., finite control set model predictive control, disturbance observer-based control, deep reinforcement learning control, integer programming, and mixed integer programming) with focusing on application to direct electric drives for both permanent magnet machines and electric vehicles. The position is for 2 years at the first instance, but it is extendable up to 3 years.

Job Description

Job Grade: Specialist and Supporting Academic Grade 6

Job Purpose
The successful candidate will conduct research in developing analysis and design tools for control and optimisation of dynamic systems (e.g., power electronics, and electric machines) with high-level goals, discrete control inputs, disturbances and uncertainties.

Job Duties [suggested wording to include a breakdown of <u>at least</u> 3 project specific requirements of the role]
- To develop discrete actuation property representation and analysis techniques for a wide range of fast discrete-actuated control systems
- To establish baseline Modulator-free Performance-Oriented Control (M_fPOC) synthesis approaches with high computational efficiency for pure fast discrete-actuated control systems
- To establish robust M_fPOC synthesis approaches to counteract disturbances and uncertainties

- To implement and verify the proposed analysis and design methods using simulation and other available means
- To support and work with PhD students to implement the proposed tools on electric machine and electric vehicle case studies
- To collaborate and work with the PI, other research staff, and industrial partners
- To write reports, conference and journal papers on the research outcomes and make presentations on the work to present to academic and other patterners
  To understand such other duties as may reasonably be 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 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 Equality & Diversity policy and procedures at all times. Duties must be carried out in accordance with relevant Equality & Diversity legislation and University policies/procedures.

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

Organisational Responsibility

Reports to

Person Specification

Your application will be reviewed with respect to meeting the essential and desirable criteria listed below. 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	Background in intelligent electrification, control systems, machines and drives, power electronics, electric vehicles	1,3
	Experience in doing research related to any of the following topics: finite control set model predictive control, disturbance observer-based control, deep reinforcement learning control	1,3
	Experience in doing research related to any of the following application areas: control and optimisation of electric machines, power electronics, electric vehicles, robotics and mechatronic systems	1,3
	Authoring original work for academic journal papers, conference papers or technical reports	1,3
	Experience of computer programming	1,3
Skills and abilities	An appreciation and understanding of direct electric drive control problem	1,3
	Ability to work independently and as part of a cross-disciplinary team	3
	Ability to take part in collaborative research activities	3
	Excellent written and oral communication skills	3
	Self-motivated with ability to meet deadlines	3
	Excellent interpersonal, and organisational skills	3
	Working knowledge of software packages, e.g., Matlab	3
	Working knowledge of specific analytical, numerical methods, e.g., integer programming, and mixed integer programming	3
	Ability to write project reports and make technical presentations to industrial and academic research groups	3
Training	Demonstrate evidence of having undertaken further training	3
Qualifications	A PhD (or near completion) in control engineering, electric engineering, computer science or mathematics	1
Other	Commitment to observing the University's Equal Opportunities policy at all times.	1,3
	Willingness to travel for meetings and conferences sometimes internationally and requiring overnight stay	3

Desirable Criteria

Area	Criteria	Stage
Experience	Experience in developing and verifying performance-oriented control and optimisation problem, stability and robustness of model predictive control approaches	1,3
	Knowledge of electric machines or related engineering contexts	1,3
	A strong publication track record	1
Skills and abilities	Strong analytical and programme skills	1,3
	A strong team player, and strong leadership skills for working with others	1,3
	Strong scientific writing skills	1,3
Qualifications	A PhD (or near completion) in a subject related to theoretic study of control engineering, electric machine drives, power electronics, and electric vehicles	1

Conditions of Service

The position is FULL TIME and FIXED TERM for 24 months. Salary will be on Specialist and Supporting Academic Grade 6, £30,942 – 39,152 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 and has a number of family-friendly policies which can be found here.

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/a-z/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 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. For further information on Athena SWAN see
http://www.lboro.ac.uk/services/hr/athena-swan/

Applications

The closing date for receipt of applications is **2nd October 2022.**

Interviews will be held w/c 10th October 2022.