

FURTHER PARTICULARS OF APPOINTMENT

THE UNIVERSITY OF MANCHESTER

FACULTY OF SCIENCE & ENGINEERING

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

POSTDOCTORAL RESEARCH ASSOCIATE OR RESEARCH FELLOW IN

FEEDBACK CONTROL THEORY / MATHEMATICAL SYSTEMS THEORY

VACANCY REF: S&E-030243

Salary: Depending on experience.

Grade 6: £37,694 to £46,049 per annum (Postdoctoral Research Associate scale),

Grade 7: £47,389 to £58,225 per annum (Research Fellow scale).

Hours: Full time

Duration: Fixed term for 3 years, starting as soon as possible after interview

Location: Department of Electrical & Electronic Engineering, School of Engineering, University of Manchester, Oxford Road, Manchester M13 9PL, UK

Responsible to: Professor Alexander Lanzon, Chair in Control Engineering

Enquiries about the vacancy, shortlisting and interviews:

Line Manager: Professor Alexander Lanzon

Email: Alexander.Lanzon@manchester.ac.uk

Scope of the Job

Applications are invited for a Postdoctoral Research Associate (PDRA) or a Research Fellow (RF) position to conduct fundamental, model-based, feedback control theory research in passivity and dissipativity theory. Applicants are expected to have strong skills in mathematical systems theory, linear algebra, and functional analysis, including an understanding of Hilbert spaces and function spaces such as L_2 and L_2^e , and manipulation of L_2 -norms, L_2 -induced (system) norms, and inner-products on L_2 . Knowledge of robustness analysis via Integral Quadratic Constraint (IQC) theory, absolute stability theory, multiplier theory, and the classical small-gain theorem would be also beneficial.

The successful applicant will work under the direction of Prof. Alexander Lanzon, Chair in Control Engineering at the University of Manchester, and will deliver the objectives of an

EPSRC research grant entitled “Input-restricted robust feedback control of nonlinear dynamical systems”.

The recruited applicant will generalise classical robust analysis results (e.g. the small gain theorem, the passivity theorem, dissipativity theory, IQC theory, and absolute stability criteria) to create new robust feedback stability analysis results suitable when exogenous signals entering the feedback loop are norm-restricted.

We welcome applications from candidates who may not yet have extensive experience in functional analysis but who possess a solid theoretical foundation in mathematical systems theory and a demonstrated capacity to rapidly acquire advanced concepts in functional analysis. Applicants whose background is limited to basic linear algebra or the application of state-space system theory, without rigorous theoretical grounding, are unlikely to be suitable.

The successful applicant will have demonstrable potential for performing leading-edge control theory / mathematical systems theory research at a high international level. The recruited applicant will be expected to publish outstanding research in IEEE Transactions on Automatic Control and Automatica.

Background Environment

The University of Manchester lies in the heart of Manchester and has a tradition of success that stretches back over 200 years – the birth of the first programmable computer, the splitting of the atom, the founding principles of modern economics, and the discovery of graphene – these and many more world changing innovations have their root at our University. The University of Manchester ranks in the top 50 universities in all global league tables. The University has a bold and exciting plan to be one of the top 25 universities in the world by 2030, backed by an on-going £1 billion investment in facilities, staff, and buildings. A new purpose-built £500 million Engineering Building, which brings together 5 engineering departments in the heart of the University’s thriving campus, has just opened in September 2022. It is one of the UK’s largest multi-disciplinary engineering hubs with 250 unique laboratory facilities unrivalled in scale and scope, and includes two new laboratories dedicated exclusively to control systems research which are a hive of activity.

The University of Manchester has a long-standing, internationally renowned reputation for control systems research within its internationally well-known Control Systems Centre. The current control systems group has 15 academics (including 5 professors) with expertise in diverse areas of feedback control theory and its applications. The significant control systems research activities at Manchester are supported by c. 50 PhD students and early career researchers. The group also runs an internationally leading MSc programme in Control Systems with c. 80 students each year which is a source of outstanding talent for hiring PhD students, thereby moulding a future generation of control systems scientists and engineers.

Key Responsibilities, Accountabilities or Duties

For the *Postdoctoral Research Associate* post, you will be expected to:

- conduct research under the direction of Prof A Lanzon;
- produce internationally leading journal papers, top quality conference papers, and other scholarly material of demonstrable excellence;

- write high quality research proposals under the direction of Prof A Lanzon to secure new research funding;
- work closely, collaboratively and synergistically with Prof A Lanzon and other members of his research team;
- attend all meetings pertaining to this research;
- disseminate research results at inter/national conferences and other institutions;
- organise outreach events pertaining to this research;
- support Prof A Lanzon with research, teaching, and administrative assistance as required;
- deliver all duties in a timely manner before deadlines and to a high quality standard;
- adhere to all policies and procedures of the University.

For the *Research Fellow* post, you will be additionally expected to:

- be highly productive in evolving research directions, writing papers and research proposals;
- possess a high degree of maturity in conducting research, writing publications and research proposals under the supervision of Prof A Lanzon;
- co-supervise PhD students of Prof A Lanzon, as requested, in topics related to this research project.

Selection Criteria For The Post

For the *Postdoctoral Research Associate* post, the following criteria will apply:

1. a PhD degree, or equivalent, in a relevant area of model-based Feedback Control Theory or Mathematical Systems Theory;
2. strong mathematical and control theory skills;
3. strong knowledge of some of these topics: dissipativity theory, passivity theory, IQC theory, absolute stability theory, multiplier theory, functional analysis, mathematical systems theory, feedback stability analysis, and model-based feedback control theory;
4. publications in leading international journals on topics relevant for this post;
5. research experience with world-leading academics or at world-leading institutions;
6. ability to self-motivate, initiate new research and evolve it independently to conclusion;
7. excellent English language skills, presentation abilities, and inter-personal skills.

For the *Research Fellow* post, the following additional criteria will also apply:

- a. excellent knowledge of most of these topics: dissipativity theory, passivity theory, IQC theory, absolute stability theory, multiplier theory, functional analysis, and mathematical systems theory;
- b. a strong record of internationally leading publications on topics relevant for this post;
- c. relevant prior postdoctoral experience.

Please state succinctly (1-2 sentences) how you meet each selection criterion and please submit a detailed CV which includes your list of publications with the online application form.

Please include names and contact details of academic referees who can comment on your research abilities.