

Summary

| | |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Job title | Postdoctoral Research Associate in Machine Learning for Grid-Edge Flexibility |
| Division | Mathematical, Physical and Life Sciences Division |
| Department | Engineering Science |
| Location | Information Engineering Building, Parks Road, Oxford, OX2 6NJ |
| Grade and salary | Grade 7: £38,674 - £46,913 per annum |
| Hours | Full time |
| Contract type | Fixed term for 36 months (or up to end of June 2028) |
| Reporting to | Professor Thomas Morstyn |
| Vacancy reference | 178762 |
| Additional information | In-person role. (Whilst the role is a grade 7 position, we would be willing to consider candidates with potential but less experience who are seeking a development opportunity, for which an initial appointment would be at grade £34,982 - £40,855 per annum with the responsibilities adjusted accordingly. This would be discussed with applicants at interview/appointment where appropriate.) |

| | |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Research topic | Machine learning for large-scale near real-time coordination of grid-edge devices to provide power system flexibility. |
| Principal Investigator / supervisor | Professor Thomas Morstyn |
| Funding partner | This post is funded by the EPSRC-FNR project "FleXEdge - Data-Driven Cloud-to-Edge Computing for Scalable Near Real-Time Local Flexibility Markets". |
| Recent publications | <p>- Y. Zhou, C. Essayeh, T. Morstyn "Aggregated Feasible Active Power Region for Distributed Energy Resources with a Distributionally Robust Joint Probabilistic Guarantee", <i>IEEE Transactions on Power Systems</i>, 2024. Doi: 10.1109/TPWRS.2024.3392622</p> <p>- F. Charbonnier, B. Peng, J. Vienne, E. S. Stai, T. Morstyn, M. McCulloch, "Centralised Rehearsal of Decentralised Cooperation: Multi-Agent Reinforcement Learning for the Scalable Coordination of Residential Energy Flexibility", <i>Applied Energy</i>, 2024. doi: 10.1016/j.apenergy.2024.124406</p> |



The role

The University of Oxford is recruiting a postdoctoral research associate to undertake original research on the use of machine learning for the large-scale near real-time coordination of grid-edge power system flexibility. As part of the transition to net-zero carbon emissions, millions of grid-edge devices, including electric vehicles (EVs), heat pumps (HPs), and home/community batteries will be added to the Great Britain (GB) power system over the next decade. Studies have shown that flexibility equivalent to multiple large power plants can be obtained from grid-edge devices with only small adjustments in usage. However, the major challenge is that computational complexity and communication requirements make traditional centralised dispatch infeasible for grid-edge devices. The research associate will undertake original research on multi-agent reinforcement learning to coordinate grid-edge flexibility across spatial and temporal scales, while accounting for network constraints and uncertainty. Collaborating with other researchers on the project, they will also contribute to the design of a supporting cloud-to-edge computing architecture and profit-sharing mechanisms for grid-edge device federations participating in local and national flexibility markets. This will bring together research on power systems modelling, multi-agent control, machine learning and mechanism design.

The position is supported by the EPSRC-FNR research project “FlexEdge – Data-Driven Cloud-to-Edge Computing for Scalable Near Real-Time Local Flexibility Markets”. The research associate will be based with the Power Systems Architecture Lab, led by Professor Thomas Morstyn. The project will involve close collaboration with project teams at Imperial College London, the Edinburgh Parallel Computing Centre (EPCC) and the Luxembourg Institute of Science and Technology (LIST). The research associate will also have the opportunity to work with industry partners: the National Energy System Operator (NESO), SP Energy Networks, Piclo, Siemens, Energy Systems Catapult and Typhoon HIL.

Responsibilities

Specific Duties

- Investigate stakeholder needs to develop detailed problem specifications for grid-edge flexibility coordination applications, and a curriculum of test problems for these applications varying in scale and complexity.
- Investigate the design of novel coordination strategies for flexible grid-edge devices, utilising state-of-the-art methods from multi-agent machine learning.
- Collaborate with other researchers on the design of a cloud-to-edge computing architecture supporting the new grid-edge device coordination strategies.
- Collaborate with other researchers on profit-sharing mechanisms for grid-edge device federations participating in local and national flexibility markets.
- Code software and gather open datasets needed to support machine learning model design, training, testing and scale-up.
- Support wider interdisciplinary collaboration, knowledge transfer and research impact.
- Publish research results at international conferences and in high impact peer reviewed journals.
- Attend project meetings and meetings with partners and collaborators as needed. This may require occasional travel within the UK or overseas.

Additional Duties

- Manage own academic research and administrative activities. This will involve project management and coordinating multiple aspects of work to meet deadlines.
- Contribute ideas for new research projects.

- Collaborate in the preparation of scientific reports and journal articles and the presentation of conference papers and posters.
- Provide information and advice to other members of the research group.
- Represent the research group at external meetings/seminars.
- Carry out collaborative projects with colleagues in partner institutions, and research groups.
- The researcher may have the opportunity to undertake ad-hoc paid teaching (e.g. lecturing, demonstrating, tutoring and co-supervision of graduate students). Permission must be sought in advance for each opportunity.
- Any other duties appropriate with the role.

Selection criteria

Essential selection criteria

- Hold a relevant PhD/DPhil or be near completion* in electrical engineering, computer science, applied mathematics or another related area.
- Research experience with machine learning for control and/or optimisation applications.
- Programming experience, preferably with Python.
- Track record of high-quality published academic work.
- Ability to manage independent academic research and associated activities.
- Excellent communication skills, including the ability to write for publication, present research proposals and results, and represent the research group at meetings.

**please note that 'near completion' means that you must have submitted your PhD thesis.*

Desirable selection criteria

- Experience with multi-agent reinforcement learning.
- Experience with power system modelling and control.
- Experience with electricity market modelling and design.
- Experience with safe machine learning.
- Experience with GPU computing and/or edge computing.

Pre-employment screening

Standard checks

If you are offered the post, the offer will be subject to standard pre-employment checks. You will be asked to provide: proof of your right-to-work in the UK; proof of your identity; and (if we haven't done so already) we will contact the referees you have nominated. You will also be asked to complete a health declaration so that you can tell us about any health conditions or disabilities for which you may need us to make appropriate adjustments.

Please read the candidate notes on the University's pre-employment screening procedures at: <https://www.jobs.ox.ac.uk/pre-employment-checks>

About the University of Oxford

Welcome to the University of Oxford. We aim to lead the world in research and education for the benefit of society both in the UK and globally. Oxford's researchers engage with academic, commercial

and cultural partners across the world to stimulate high-quality research and enable innovation through a broad range of social, policy and economic impacts.

We believe our strengths lie both in empowering individuals and teams to address fundamental questions of global significance, while providing all our staff with a welcoming and inclusive workplace that enables everyone to develop and do their best work. Recognising that diversity is our strength, vital for innovation and creativity, we aspire to build a truly diverse community which values and respects every individual's unique contribution.

While we have long traditions of scholarship, we are also forward-looking, creative and cutting-edge. Oxford is one of Europe's most entrepreneurial universities and we rank first in the UK for university spin-outs, and in recent years we have spun out 15-20 new companies every year. We are also recognised as leaders in support for social enterprise.

Join us and you will find a unique, democratic and international community, a great range of staff benefits and access to a vibrant array of cultural activities in the beautiful city of Oxford.

For more information, please visit www.ox.ac.uk/about/organisation.

Engineering Research Group

The role is based with the Power Systems Architecture Lab led by Professor Thomas Morstyn, which focuses on power system digitalisation and market design. For more details see: eng.ox.ac.uk/psal

The associate will have access to the ZERO Institute Early Career Researcher Network, which supports early career energy researchers in Oxford. The network features enrichment, networking, policymaking, industrial engagement and outreach with bi-weekly meetings. For more details: zero.ox.ac.uk/ecr-network

Engineering Science Department

Engineering teaching and research takes place at Oxford in a unified Department of Engineering Science whose academic staff are committed to a common engineering foundation as well as to advanced work in their own specialties, which include most branches of the subject. We have especially strong links with computer science, materials science, medicine and also the Saïd Business School. The Department employs 120 academic staff (this number includes 13 statutory professors appointed in the main branches of the discipline, and 25 full professors); in addition, there are nine visiting professors. There is an experienced team of teaching support staff, professional services and administrative staff and technicians. The Department has well-equipped laboratories and workshops, which together with offices, lecture theatres, library and other facilities have a net floor area of about 25,000 square metres.

The Department is ranked fifth in the world, and the top European University, in the 2023 *Times Higher Education World University Rankings* for Engineering & Technology. Further information about the Department is available at www.eng.ox.ac.uk.

Teaching

We aim to admit 170-180 undergraduates per year to take a 4-year course leading to the MEng degree in Engineering Science. The course is accredited at MEng level by the major engineering institutions. The syllabus has a common core extending through the first two years. Specialist options are introduced in the third year, and the fourth year includes further specialist material and a major project.

Research

Research in the Department is particularly strong. We have approximately 600 research students and about 250 postdoctoral researchers. Direct funding of research grants and contracts, from a variety of sources, amounts to an annual turnover of approximately £70m.

The results of the seven-yearly UK-wide assessment of university research, REF2021, published on 12th May 2022, demonstrate that the University of Oxford made the highest volume of world-leading research submissions. The Department of Engineering Science had 71% of submissions which met the requirements for the highest grading of 4*(research that is world-leading in terms of originality, significance, and rigour).

Research activities fall into 8 broad headings, though there is much overlapping in practice: Information Engineering (Robotics, Computer Vision and Machine Learning); Control; Thermofluids; Materials and Mechanics; Civil and Offshore; Electrical and Optoelectronic; Chemical and Process; and Biomedical.

The Department of Engineering Science holds a bronze Athena Swan award to recognise advancement of gender equality: representation, progression and success for all.

The Mathematical, Physical, and Life Sciences Division

The Mathematical, Physical, and Life Sciences (MPLS) Division is one of the four academic divisions of the University. In the results of the six-yearly UK-wide assessment of university research, REF2014, the MPLS division received the highest overall grade point average (GPA) and the highest GPA for outputs. We received the highest proportion of 4* outputs, and the highest proportion of 4* activity overall. More than 50 per cent of MPLS activity was assessed as world leading.

The MPLS Division's 10 departments and 3 interdisciplinary units span the full spectrum of the mathematical, computational, physical, engineering and life sciences, and undertake both fundamental research and cutting-edge applied work. Our research addresses major societal and technological challenges and is increasingly focused on key interdisciplinary issues. MPLS is proud to be the home of some of the most creative and innovative scientific thinkers and leaders working in academe. We have a strong tradition of attracting and nurturing the very best early career researchers who regularly secure prestigious fellowships

We have around 6,000 students and play a major role in training the next generation of leading scientists. Oxford's international reputation for excellence in teaching is reflected in its position at the top of the major league tables and subject assessments.

MPLS is dedicated to bringing the wonder and potential of science to the attention of audiences far beyond the world of academia. We have a strong commitment to supporting public engagement in science through initiatives including the Oxford Sparks portal (<http://www.oxfordsparks.net/>) and a large variety of outreach activities. We also endeavour to bring the potential of our scientific efforts forward for practical and beneficial application to the real world and our desire is to link our best scientific minds with industry and public policy makers.

For more information about the MPLS division, please visit: <http://www.mpls.ox.ac.uk/>

How to apply

Applications are made through our online recruitment portal. Information about how to apply is available on our Jobs website <https://www.jobs.ox.ac.uk/how-to-apply>.

Your application will be judged solely on the basis of how you demonstrate that you meet the selection criteria stated in the job description.

As part of your application you will be asked to provide details of two referees and indicate whether we can contact them now.

You will be asked to upload a CV and a supporting statement. **The supporting statement must explain in detail how you meet each of the selection criteria for the post using examples of your skills and experience.** This may include experience gained in employment, education, or during career breaks (such as time out to care for dependants)

Please upload all documents **as PDF files** with your name and the document type in the filename.

All applications must be received by **midday** UK time on the closing date stated in the online advertisement.

Information for priority candidates

A priority candidate is a University employee who is seeking redeployment because they have been advised that they are at risk of redundancy, or on grounds of ill-health/disability. Priority candidates are issued with a redeployment letter by their employing department(s).

If you are a priority candidate, please ensure that you attach your redeployment letter to your application (or email it to the contact address on the advert if the application form used for the vacancy does not allow attachments).

If you need help

Application FAQs, including technical troubleshooting advice is available at:

<https://staff.web.ox.ac.uk/recruitment-support-faqs>

Non-technical questions about this job should be addressed to the recruiting department directly:

recruitment@eng.ox.ac.uk

To return to the online application at any stage, please go to: www.recruit.ox.ac.uk.

Please note that you will receive an automated email from our online recruitment portal to confirm receipt of your application. **Please check your spam/junk mail** if you do not receive this email.

Important information for candidates

Data Privacy

Please note that any personal data submitted to the University as part of the job application process will be processed in accordance with the GDPR and related UK data protection legislation. For further information, please see the University's Privacy Notice for Job Applicants at:

<https://compliance.admin.ox.ac.uk/job-applicant-privacy-policy>. The University's Policy on Data Protection is available at: <https://compliance.admin.ox.ac.uk/data-protection-policy>.

The University's policy on retirement

The University operates an Employer Justified Retirement Age (EJRA) for very senior research posts at **grade RSIV/D35 and clinical equivalents E62 and E82**, which with effect from 1 October 2023 will be 30 September before the 70th birthday. The justification for this is explained at:

<https://hr.admin.ox.ac.uk/the-ejra>.

For **existing** employees on these grades, any employment beyond the retirement age is subject to approval through the procedures: <https://hr.admin.ox.ac.uk/the-ejra>.

There is no normal or fixed age at which staff in posts at other grades have to retire. Staff at these grades may elect to retire in accordance with the rules of the applicable pension scheme, as may be amended from time to time.

Equality of opportunity

Entry into employment with the University and progression within employment will be determined only by personal merit and the application of criteria which are related to the duties of each particular post and the relevant salary structure. In all cases, ability to perform the job will be the primary consideration. No applicant or member of staff shall be discriminated against because of age, disability, gender reassignment, marriage or civil partnership, pregnancy or maternity, race, religion or belief, sex, or sexual orientation.

Benefits of working at the University

Employee benefits

University employees enjoy 38 days' paid holiday, generous pension schemes, travel discounts, and a variety of professional development opportunities. Our range of other employee benefits and discounts also includes free entry to the Botanic Gardens and University colleges, and discounts at University museums. See <https://hr.admin.ox.ac.uk/staff-benefits>

University Club and sports facilities

Membership of the University Club is free for all University staff. The University Club offers social, sporting, and hospitality facilities. Staff can also use the University Sports Centre on Iffley Road at discounted rates, including a fitness centre, powerlifting room, and swimming pool. See www.club.ox.ac.uk and <https://www.sport.ox.ac.uk/>.

Information for staff new to Oxford

If you are relocating to Oxfordshire from overseas or elsewhere in the UK, the University's Welcome Service website includes practical information about settling in the area, including advice on relocation, accommodation, and local schools. See <https://welcome.ox.ac.uk/>

There is also a visa loan scheme to cover the costs of UK visa applications for staff and their dependents. See <https://staffimmigration.admin.ox.ac.uk/visa-loan-scheme>

Family-friendly benefits

With one of the most generous family leave schemes in the Higher Education sector, and a range of flexible working options, Oxford aims to be a family-friendly employer. We also subscribe to the Work+Family Space, a service that provides practical advice and support for employees who have caring responsibilities. The service offers a free telephone advice line, and the ability to book emergency back-up care for children, adult dependents and elderly relatives. See <https://hr.admin.ox.ac.uk/my-family-care>

The University has excellent childcare services, including five University nurseries as well as University-supported places at many other private nurseries.

For full details, including how to apply and the costs, see <https://childcare.admin.ox.ac.uk/>

Disabled staff

We are committed to supporting members of staff with disabilities or long-term health conditions. For further details, including information about how to make contact, in confidence, with the University's Staff Disability Advisor, see <https://edu.admin.ox.ac.uk/disability-support>

Staff networks

The University has a number of staff networks including the Oxford Research Staff Society, BME staff network, LGBT+ staff network and a disabled staff network. You can find more information at <https://edu.admin.ox.ac.uk/networks>

The University of Oxford Newcomers' Club

The University of Oxford Newcomers' Club is an organisation run by volunteers that aims to assist the partners of new staff settle into Oxford, and provides them with an opportunity to meet people and make connections in the local area. See www.newcomers.ox.ac.uk.