## PhD studentship (Full-time)

| Institution | **Xi'an Jiaotong-Liverpool University, China**<br>**University of Liverpool, U. K.** |
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| School | **School of Advanced Technology** |
| Supervisors | Principal supervisor: **Assoc. Prof. Dr. Chee Shen LIM (XJTLU)**<br>Co-supervisor: **Assoc. Prof. Dr. Fei XUE (XJTLU)**<br>Co-supervisor: **Dr. Zhongbei TIAN (UoL)** |
| Application Deadline | Open until the position is filled (December entry deadline is 30th September 2022; read below for details) |
| Funding Availability | Funded PhD project (world-wide students) |
| Project Title | **Machine Learning-Enhanced Predictive Controls of Power Electronic Converters** |
| Contact | If you would like to know more about the PhD studentship as well as the project potentials, please email cheeshen.lim@xjtlu.edu.cn (XJTLU principal supervisor's email address) with a subject line of the PhD project title.<br><br>The principal supervisor's profile can be found here:<br>https://www.xjtlu.edu.cn/en/departments/academic-departments/electrical-and-electronic-engineering/staff/cheeshen-lim |

**Requirements:**

The candidate should have a first class or upper second class honours degree, or a master's degree (or equivalent qualification), in **electrical engineering**, **electronic engineering**, **E&E engineering**, **mechatronics**, **controls**, or **computer science (M/BEng)**.

Evidence of good spoken and written English is essential. The candidate should have an IELTS score of 6.5 or above, if the first language is not English. This position is open to all qualified candidates irrespective of nationality.

**Degree:**

The student will be awarded a **PhD degree from the University of Liverpool (UK)** upon successful completion of the program.

**Funding:**

The PhD studentship is available for three years subject to satisfactory progress by the student. The award covers tuition fees for three years (currently equivalent to **RMB 80,000 per annum**). It also provides up to **RMB 16,500** to allow participation at international conferences during the period of the award. The scholarship holder is expected to carry out the major part of his or her research at XJTLU in **Suzhou**, China.

The position includes a period of **research study visit** period of duration 3 to 6 months, depending on the final project plan, to **University of Liverpool** to work primarily with the co-supervisor. The research project associated with this PhD studentship will also be supported **by other internal and/or external research fundings**.

Excellent candidate will be recommended for **teaching assistantship** and **research assistantship** in other governmental/industrial research projects, with which additional stipends will be paid.

**Project Description**:

Model predictive control (MPC) techniques, which share the same optimization functional layer as most artificial intelligence algorithms, have received increasing attention since late 2000s. Known advantages of MPC include control optimality and versatility, fast dynamics, and constrain consideration, as well as its unique ability in considering hybrid discrete-continuous nature of power electronic systems (PESs). Specifically, non-linear finite-control-set model predictive control has been an active research subject in recent years. Being the most widely studied variant, the control method has been investigated in conjunction with various power converter topologies and applications. Despite the advantages of excellent dynamics and model-based design, this category of predictive controls has limitations in terms steady-state performance, parameter dependence, and "white-box model" requirement.

Most machine learning solutions in modern energy systems focus on large-system design and maintenance where the developed algorithms are based primarily on the assumptions of having "abundant" computing resources (memory, computing speed) and being non-time and non-safety critical. Embedded PESs, however, do not inherit many of these properties. This project aims to introduce stochastic feature into the predictive control design by augmenting it with embedded machine learning. It is envisaged that the newly introduced stochasticity can improve the aforementioned gaps that cannot be addressed easily through existing control design methodologies. The research project will be substantiated by theoretical derivation, algorithm development, simulation study, and experimental proof (through the power electronics and smart energy system experimental facilities available in the school's research laboratories).

For more information about doctoral scholarship and PhD programme at Xi'an Jiaotong-Liverpool University (XJTLU), please visit

**https://www.xjtlu.edu.cn/en/admissions/doctoral/entry-requirement-phd/**
**https://www.xjtlu.edu.cn/en/admissions/doctoral/postgraduate-research-scholarships**

**Principal and Co-Supervisor Academic Profiles**

Dr. Chee Shen LIM received the B.Eng. (Hons.) degree in electrical engineering from the University of Malaya, Kuala Lumpur, Malaysia, in 2009, and the joint-university PhD degrees in power electronics and drives from the university of Malaya, Kuala Lumpur, and Liverpool John Moores University, Liverpool, U.K., in 2013. From 2013 to 2015, he was a Research Scientist with the Experimental Power Grid Centre, Agency for Science, Technology and Research, Singapore. From 2015 to 2021, he was an Assistant/Associate Professor of Electrical and Electronic Engineering with the University of Southampton (branch campus, Malaysia). He is currently an Associate Professor of Electrical and Electronic Engineering with Xi'an Jiaotong-Liverpool University, China. Dr. Lim is senior member of IEEE, a Chartered Engineer (CEng) and serves currently as an Associate Editor of the IET Electric Power Applications. He has extensive research experience on advanced design and controls of power electronics for various applications. In recent few years, he has researched on intelligent algorithms for advanced predictive control schemes for grid converters and multi-motor/multiphase drives, microgrid's hierarchical controls, energy management, and renewable energy forecasting.

https://www.xjtlu.edu.cn/en/departments/academic-departments/electrical-and-electronic-engineering/staff/cheeshen-lim
https://scholar.google.com/citations?user=Q6_m79IAAAAJ&hl=en
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https://www.liverpool.ac.uk/electrical-engineering-and-electronics/staff/zhongbei-tian/

**How to Apply:**

Prospective candidates are suggested to email cheeshen.lim@xjtlu.edu.cn, preferably with a short CV and personal statement, before **31st August 2022 (soft deadline)** for informal query about the project scope and potentials (recommended; please put the project title in the subject line). It should be noted that the next available entry/enrolment point in 2022 is **December 2022**, and the corresponding deadline of formal application is **30th September 2022 (hard deadline)**.

Alternatively, interested applicants can also email cheeshen.lim@xjtlu.edu.cn (XJTLU principal supervisor's email address) the following documents for review and assessment.

- CV
- Two formal reference letters
- Personal statement outlining your interest in the position
- Certificates of English language qualifications (IELTS or equivalent)
- Full academic transcripts in both Chinese and English (for international students, only the English version is required)
- Verified certificates of education qualifications in both Chinese and English (for international students, only the English version is required)
- PDF copy of Master Degree dissertation (or an equivalent writing sample) and examiners reports available