

## PhD studentship (Full-time)

Institution	Xi'an Jiaotong-Liverpool University, China
School	School of Advanced Technology
Supervisors	Principal supervisor: Assoc. Prof. Dr. Chee Shen LIM (XJTLU) Co-supervisor: S. Assoc. Prof. Fei XUE (XJTLU) Co-supervisor: Dr. Chao LONG (UoL)
Application Deadline	Open until the position is filled
Funding Availability	Funded PhD project (world-wide students)
Project Title	Fault tolerant control of AC drives based on machine learning technology
Contact	Please email <a href="mailto:cheeshen.lim@xjtlu.edu.cn">cheeshen.lim@xjtlu.edu.cn</a> (XJTLU principal supervisor's email address) with a subject line of the PhD project title.  The principal supervisor's profile is linked here: <a href="https://scholar.xjtlu.edu.cn/en/persons/CheeshenLim">https://scholar.xjtlu.edu.cn/en/persons/CheeshenLim</a> <a href="https://scholar.google.com/citations?user=Q6_m79IAAAAJ&amp;hl=en&amp;oi=ao">https://scholar.google.com/citations?user=Q6_m79IAAAAJ&amp;hl=en&amp;oi=ao</a>

### **Requirements:**

A Master's degree with Merit and a Bachelor's degree with first-class or upper second-class honors are required for PhD admissions. Exceptional candidates holding only a Bachelor's degree may be considered on an individual basis in certain disciplines.

Evidence of good spoken and written English is essential. The candidate should have an IELTS (or equivalent) 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 99,000 per annum). It also provides up to RMB 16,500 to allow participation at international conferences during the period of the award. The scholarship holders are expected to conduct the majority of their

research at XJTLU in Suzhou, China. However, they may apply for a short-term research visit to the University of Liverpool if the project requires it.

### **Project Description:**

With the rapid development of power electronics and sensor technologies and control theory, three-phase and multi-phase AC machines are now increasingly used in safety critical applications such as transportation and power grids systems. However, fault tolerance control and fault diagnosis are becoming increasingly relevant and important. The traditional, industry-focused fault diagnosis method is usually of slower responses, and based on threshold and parameter adjustment, which has great limitations and cannot deal with complex actual working conditions, such as inter-turn faults, in safety critical applications. In recent years, the rapid development of machine learning technology provides a new way to revisit this problem and potentially offer new solutions. This project aims to achieve fault tolerant control of multi-phase AC motors through machine learning technology, improve the reliability of motor drive system, reduce maintenance costs, and promote the application and development of intelligent technology in the field of machine-drive systems for safety critical fields.

In recent years, both academia and industry have shown keen interest in fault-tolerant control for electric drive systems. Key areas of focus include fault detection, fault diagnosis, and the development of fault-tolerant control strategies. Three-phase and multiphase AC motor systems, both of permanent magnet and reluctance types, are particularly attractive due to their high fault tolerance, especially in electric vehicles and renewable energy systems. Current research focuses on improving the accuracy of fault detection algorithms, reducing reliance on complex hardware, and enhancing system performance under fault conditions.

With the increasing demand for electric motor drives in consumer and commercial transport vehicles, including heavy-duty road vehicles, ships and vessels, and even more electric aircraft, the reliability of motor drive systems has become an increasingly important issue. Over the past two decades, various fault-tolerant three-phase motor drive topologies have been introduced and investigated, targeting the conventional industrial applications. Post-fault power evaluation for fault-tolerant drives should consider torque and speed after a fault, which depend on post-fault current and voltage limits. On the other hand, with the continuous development of power semiconductor technology such as the increasingly wider adoption of the third generation power electronic devices, as well as the ever developing embedded computing and intelligence technologies, it is expected that their integration into multiphase electric drive systems are becoming fitting and timely.

The above-mentioned multi-disciplinary engineering technologies form the basis of this project. The main objectives including modeling of multiphase motor drives, supplied by fast-switching power electronic devices under fast closed-loop control actions, for normal operation and phase fault conditions. Real-time model adjustment is expected to improve driving attributes during faults. The project will propose and investigate intelligent fault-tolerant control schemes with e.g. adaptability feature and diagnosis features for various fault conditions of the AC drive systems.

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/global/entry-requirements/>

<https://www.xjtlu.edu.cn/en/admissions/global/fees-and-scholarship>

### **How to Apply:**

Interested applicants are advised to email [cheeshen.lim@xjtlu.edu.cn](mailto:cheeshen.lim@xjtlu.edu.cn) (XJTLU principal supervisor's email address) the following documents for initial review and assessment.

- **CV**
- **Personal statement outlining your interest in the position**
- **Full academic transcripts in both Chinese and English (for international students, only the English version is required)**
- \* Certificates of English language qualifications (IELTS or equivalent)
- \*\* Two formal reference letters
- \*\* Verified certificates of education qualifications in both Chinese and English (for international students, only the English version is required)
- \*\* PDF copy of Bachelor (first class)/Master Degree dissertation

Note:

\* can either be the valid certificate, or have the intention to sit for the English tests. Some countries do not need the certificate. This requirement can be clarified after the initial review.

\*\* are only required after passing the initial review/assessment just before/during formal application.