

### PhD studentship (Full-time)

Institution	Xi'an Jiaotong-Liverpool University, China
School	School of Advanced Technology
Supervisors	Principal supervisor: Professor/Dr Yuqing Chen (XJTLU) Co-supervisor: Professor/Dr Minzhou Luo (JITRI) Co-supervisor: Professor/Dr Xinheng Wang (XJTLU) Co-supervisor: Professor/Dr Ian Sandall (UoL)
Application Deadline	Open until the position is filled
Funding Availability	Funded PhD project
Project Title	Man-machine collision detection algorithm
Contact	Please email <a href="mailto:Yuqing.chen@xjtlu.edu.cn">Yuqing.chen@xjtlu.edu.cn</a> (XJTLU principal supervisor's email address) or <a href="mailto:luomz@iimt.org.cn">luomz@iimt.org.cn</a> with a subject line of the PhD project title

#### **Requirements:**

The candidate should have a first class or upper second class honours degree, or a master's degree (or equivalent qualification) in mechanics, engineering, math, physics, etc.

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.

**Please note that the joint PhD project is industry-based and the candidate is expected to undertake part of the research at the partner organization in China.**

#### **Degree:**

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

#### **Funding:**

This PhD project is a collaborative research project between XJTLU (<http://www.xjtlu.edu.cn>) in Suzhou and JITRI (Jiangsu Industrial Technology Research Institute) JITRI Institute of Intelligent Manufacturing Technology. The

student will be registered as an XJTLU PhD student but is expected to carry out the major part of his or her research at the Institute in JITRI Institute of Intelligent Manufacturing Technology.

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). In addition, during the period of undertaking main research at institute in Suzhou, the PhD candidate will be provided with monthly living allowance at a standard 5000 RMB per month by JITRI Institute of Intelligent Manufacturing Technology.

### **Project Description:**

The main purpose of this topic is to realize the construction and motion control of the cooperative manipulator system experimental platform. It can realize fast collision detection in the case of human to human collision, so that people will not be threatened by robots. Optimize the motion index and plan a collision - free path. The path may not exist or there are multiple paths. If multiple paths exist, you need to select the optimal path based on different indicators. It is not only to meet with the environmental obstacles in the collision, but also solve the problem of avoiding collision itself, at the same time working dimensions of mechanical arm is often more than three, while the common applicable to the planning method of mobile robot in the high-dimensional space exists, large amount of calculation of the planning time is too long or not planning out the optimal path in a limited time. The master-slave motion planning model is adopted to study the constraints of position, velocity and acceleration in the process of motion, which are specified by a set of complete equality constraints. The motion error is modeled and analyzed. Finally, based on the experimental platform of dual manipulator system, the experiment of tightly coordinated motion planning of two arms is completed.

**Objective 1:** Development of man-machine collision detection algorithm. To realize the rapid detection in the case of man-machine collision, and to respond quickly, so that people will not be threatened by robot safety.

**Objective 2:** Development of optimal path planning algorithm. The optimal path needs to be selected according to some indexes, such as the shortest path, the least work, and the best control.

**Objective 3:** Master and slave manipulator work together. One of the main arms and the other is a cluster arm of a two-arm robot. To study the coordination between the master and slave arms.

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

<http://www.xjtlu.edu.cn/en/study-with-us/admissions/entry-requirements>

<http://www.xjtlu.edu.cn/en/admissions/phd/feesscholarships.html>

### **Supervisor Profile:**

#### **Principal Supervisor:**

Dr. Yuqing Chen is currently an assistant professor in Department of Mechatronics and Robotics, Xi'an Jiaotong-Liverpool University. Yuqing received his B.Eng. degree and M.Eng. degree from Harbin Institute of Technology, China and Ph.D. degree from Singapore University of Technology and Design, Singapore. Yuqing also visited Vanderbilt University, USA in 2020.

His research interest lies primarily in data-driven optimal control, which includes: 1) data-driven hardware-in-the-loop control, 2) nonlinear optimal control theory and 3) intelligent robot control systems.

<https://www.xjtlu.edu.cn/en/departments/academic-departments/mechatronics-and-robotics/staff/yuqing-chen>

#### **JITRI co-supervisor:**

Dr. MinzhouLuo, PhD and researcher of University of Science and Technology of China, is currently the President of Jiangsu JITRI Intelligent Manufacturing Technology Research Institute Co., LTD., focusing on the operation of intelligent manufacturing industry.

Dozens of the institute's self-developed products, including Human-Machine Lightweight Collaborative Robot and Intelligent Unmanned Floor-cleaning and Disinfection robot, have achieved fleet sales. The institute has made breakthrough development in many core and common technologies of robots. Dr. Luo has participated in more than 20 projects of Ministry of Science and Technology, National 863, Ministry of General Equipment, NSFC, Chinese Academy of Sciences, 12 projects of Jiangsu provincial and Nanjing municipal, and more than 50 enterprise projects.

He has published more than 130 papers, 41 of which were included in SCI and EI. He has obtained more than 20 invention patents, and 8 items of software registration. He has supervised more than 30 PhD and master students. Dr. Luo is a member of Jiangsu provincial "333 High-level Talent Project", Nanjing "Top Expert Gathering Program", "Innovative Entrepreneur Training Program", "young and middle-aged talents" and "Entrepreneurship Jiangbei" high-level entrepreneurial talents.

### **How to Apply:**

Interested applicants are advised to email [Yuqing.chen@xjtlu.edu.cn](mailto:Yuqing.chen@xjtlu.edu.cn) (XJTLU principal supervisor's email address) or [luomz@iimt.org.cn](mailto:luomz@iimt.org.cn) the following documents for initial review and assessment (please put the project title in the subject line).

- CV
- Two reference letters with company/university letterhead

- Personal statement outlining your interest in the position
- Proof of English language proficiency (an IELTS score of 6.5 or above)
- Verified school 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