

PhD studentship (Full-time)

Institution	Xi'an Jiaotong-Liverpool University, China
School	School of advanced technology
Supervisors	Principal supervisor: Professor/Dr Chen Xuan (XJTLU) Co-supervisor: Professor/Dr Minzhou Luo (JITRI) Co-supervisor: Professor/Dr Xiaowei Huang (UoL)
Application Deadline	Open until the position is filled
Funding Availability	Funded PhD project
Project Title	Stability Control of Hydraulic Foot-legged Robot in Complex Environment
Contact	Please email chenxuan@liverpool.ac.uk (XJTLU principal supervisor's email address) or luomz@iimt.org.cn 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, materials, physics, maths 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 5000RMB per month by **JITRI Institute of Intelligent Manufacturing Technology**

Project Description:

Stability control of hydraulic foot robot in complex environment; Mainly through three-dimensional modeling, hydraulic fluid theoretical analysis and calculation, fluid simulation software, as well as the actual experiment to verify the rationality of the design and the stability of the robot. Kinematics and dynamics analysis of the robot is the basis of the whole system design. At present, the research of kinematics mainly has two aspects: one is to discuss the structure, size and movement speed of each part of robot from the perspective of biology and bionics, which provides reference for the design and research of quadruped walking robot^[6]; The other is to solve the kinematics of quadruped walking robots with different structures from the perspective of mechanical engineering, especially robotics, so as to discuss the optimization of robot structure^[7].

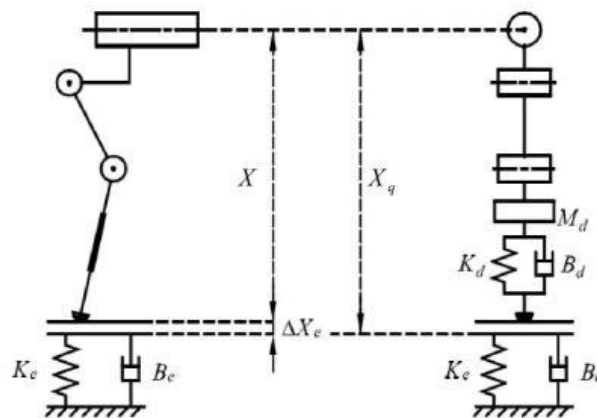


Fig.3 Simplified model of contact impedance between one leg and external environment

Based on the established virtual prototype model, this project establishes the mathematical model of kinematics and dynamics analysis of quadruped robot, which provides theoretical basis for simulation of quadruped robot motion characteristics, control system design and function realization. Specific implementation scheme: D-H method was used to establish the robot space

motion coordinate system, and the coordinate transformation matrix of each joint was deduced relative to the reference coordinate system. The forward and inverse space kinematics analysis of quadruped bionic robot is studied. The working space of bionic leg mechanism was calculated by the given range of joint angles. [8]

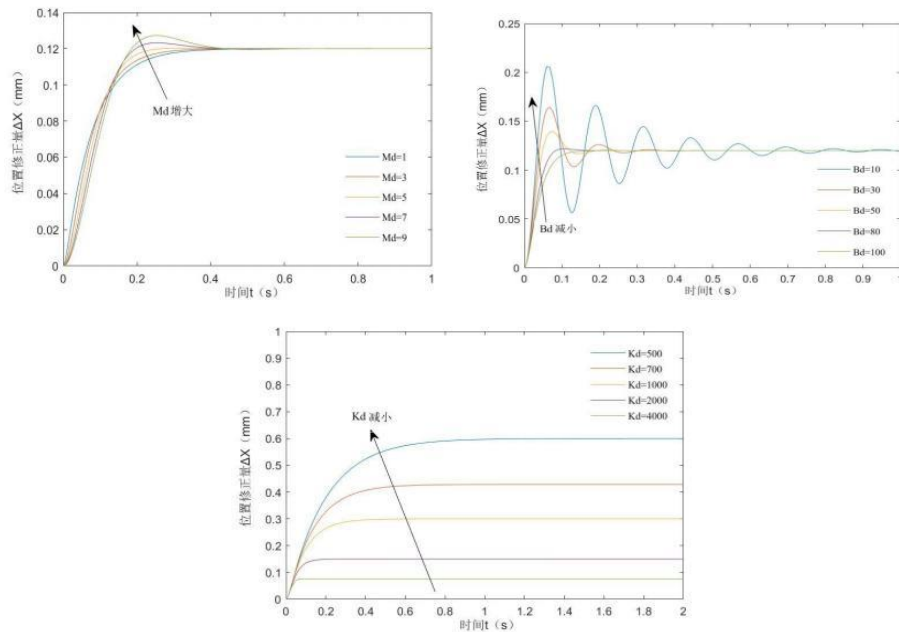


Fig.4 Change the position correction response curve of target parameters

The hydraulic system of the quadruped robot in this project is relatively complex, and the motion control of the quadruped robot is accomplished by sixteen parallel servo units. Therefore, the power-weight ratio of the integrated block-pipe network system and the energy dissipation in the transmission process are put forward stricter requirements. For the quadruped robot integrated block-pipe network system, the maximum power-weight ratio and the minimum transmission energy consumption are taken as the objective functions, and the numerical simulation method is combined with the transient flow field visualization measurement method. The accuracy of the numerical method is verified by experimental results, and the quadruped robot integrated block-pipe network system is obtained. [9]

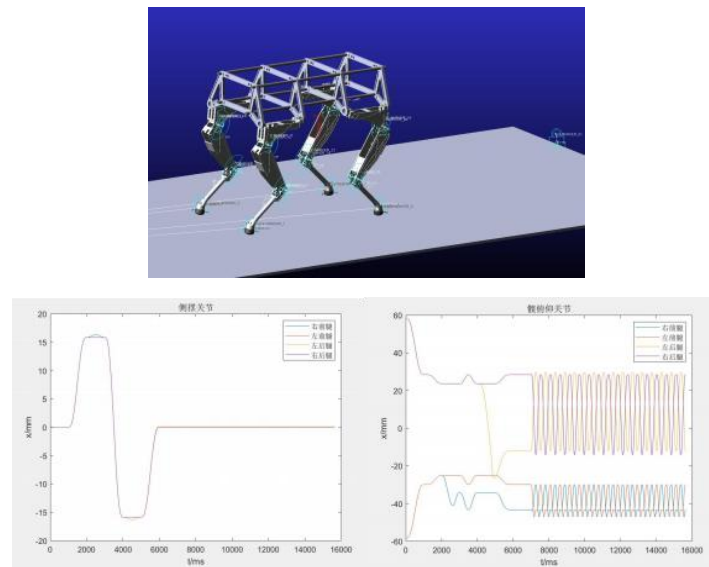


Fig.5 ADAMS simulation and quadruped joint planning trajectory diagram

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/feescholarships.html>

Supervisor Profile:

Principal Supervisor:

<https://www.xjtlu.edu.cn/zh/study/departments/academic-departments/foundational-mathematics/department-staff/academic-staff/staff/chen-xuan>

JITRI co-supervisor:

骆敏舟博士，中国科学技术大学博士，研究员。任职江苏集萃智能制造技术研究所有限公司董事长，专注于智能制造产业的经营。

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.

数十项自主研发的产品，如与人共融轻型协作机器人、智能无人洗地消毒机器人等两款产品已经实现批量销售；公司突破了多项机器人的核心与共性关键技术。

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.

参加科技部项目、国家 863 计划项目、总装备部项目、国家自然科学基金项目、中科院项目 20 余项，省市各级项目 12 项，企业项目 50 余项；共发表论文 130 多篇，SCI、EI 收录 41 篇；申请并获得发明专利 20 余项，软件著作权登记 8 项；培养博士、硕士 30 余人。

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.

江苏省“333 高层次人才培养工程”，南京“顶尖专家集聚计划”、“创新型企业企业家培育计划”，南京市“中青年拔尖人才”，“创业江北”高层次创业人才。

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 chenxuan@liverpool.ac.uk (XJTLU principal supervisor's email address) or luomz@iimt.org.cn the following documents for initial review and assessment (please put the project title in the subject line).

- CV
- Previous projects related to this advert
- 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