SEMS: RESEARCH PROJECT DESCRIPTION

1. Project Background and Description

Bioinspired Dynamic Legged Robots for Multimodal Locomotion

Learning from living systems in nature and applying principles extracted from nature for developing robust and versatile legged mobile robots, a significant scientific challenge will be to understand how to effectively design adaptive morphologies with high numbers of degrees of freedom to achieve mechanical resilience against changing environments. This project will mainly explore biological movement by employing advanced tools from data science, machine learning, and predictive analytics to extract information of locomotor morphology, thus develop a more comprehensive and structured design paradigm for legged mobile robots with adaptability. With the design paradigm, this project will further develop novel components and effectively integrated robotic systems by leveraging soft robotics technologies, functional materials based new manufacturing processes, and adaptive controllers capable of compensating for morphological changes. The bioinspired novel legged robots have potentials to be used as physical models for further reverse engineering biomechanics of locomotion in depth. The project will directly benefit from outstanding facilities in the multidisciplinary robotics lab (https://www.qmul.ac.uk/robotics/facilities/) and a variety of world-class equipment in the labs and workshop at the School of Engineering and Materials Science.

2. Project Scope

a) *Developing an interactive design system/framework for linkage-based leg mechanisms capable of compelling biological leg movements of living systems in nature*
b) *Investigating and simulating the kinematics and dynamics of integrated four-legged mobile robot platforms with optimized linkage structures for multimodal locomotion*
c) *Developing the actuation and control system for a sample dynamic legged robot and validate the agility in extensive lab experimental tests.*

3. Desired Skills from the Student

a) *Solid understanding of engineering principles needed to design, fabricate, and validate work (Essential)*
b) *Strong background in complex assembly design (Essential)*
c) *Demonstrated computer modeling/computer aided design experience, e.g. Solidworks experience (Essential)*
d) *Basic knowledge and capability in manufacturing processes, both traditional (lathe, mill, casting, etc.) and modern (laser cutter, 3D printing, etc.) (Essential)*
e) *Experience with Matlab, Python, or similar computational environment (Essential)*
f) *The minimum requirement for this studentship opportunity is a good Honours degree or MSc/MRes in mechanical or electronic engineering, or a field closely related to robotics.*
g) *If English is not your first language then you will require a valid English certificate equivalent to IELTS 6.5+ overall with a minimum score of 6 in Writing (Reading, Listening, Speaking).*

4. Supervisory Team

Primary: ***Dr Ketao Zhang***