

SEMS: RESEARCH PROJECT DESCRIPTION

1. Project Background and Description

Project title:

Computational Design of Reconfigurable Lower-Limb Rehabilitation Exoskeleton Robots

Project description:

Aimed at transferable technology and low-cost care products to assist individuals with muscle weakness or suffer from physical or neurological disorders, this project will develop a new type of lower-limb rehabilitation exoskeletons capable of adapting to patient-specific requirements by exploring light-weight reconfigurable mechanisms and soft robotics. The main areas of work are in biological system modelling, design and kinematics analysis of reconfigurable exoskeleton robot mechanisms, redundant actuation and control system development, system integration and experimental validation. This student project will be supervised jointly by Dr Ketao Zhang, an expert in robot mechanisms and reconfigurable robotic systems, and Prof Teresa Alonso-Rasgado, who is an expert in total care product design and modelling of biological systems. 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) exploring and establishing a new framework for automatically design lower-limb exoskeleton mechanisms using motion data of individual patient's lower-limb joints.
- b) designing and prototyping a lower-limb rehabilitation exoskeleton device by taking the optimal synthesis of dimensions and taking the consideration of reconfigurability
- c) developing the actuation and control system of the integrated robotic rehabilitation system and validate the prototype with lab experimental tests and clinical trials.

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 (Desired)
- 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**

Secondary: **Prof Teresa Alonso-Rasgado**

Additional: (Name (inc title)/ department or company if outside SEMS).