

|| SEMS: RESEARCH PROJECT DESCRIPTION

1. Project Background and Description

Project Title: Assistive Robotic Mobile Manipulation for Elderly in Care Settings

Project summary: Robotics in health and social care has been identified as a key area for development and investment by the **EPSRC as part of its Healthcare Technologies Grand Challenge**. The current **Industrial Strategy of the UK and its Ageing Society Grand Challenge** aims to put the UK at the forefront of autonomous robotic technologies, to enable innovative methods for healthcare solutions in nursing homes and hospitals, whilst also alleviating the need for low-skilled manual care-workers, an area in which we are facing severe shortages. Assistive robotics is an essential technological revolution currently enhancing healthcare by providing responsive physical assistance in a timely and effective way, and reducing the physical demands of caring (such as lifting and carrying) and consequent risk of injury. For robots to do useful work in human-centered spaces and alongside human co-workers, they need to be able to navigate safely and interact carefully with objects and people in the environment. The need calls for a holistic solution to autonomous mobile manipulation. The state-of-the-art robots for mobile manipulation in particular are rarely capable of both inherent compliance and high payload. To address these challenges, this project proposes developing next-generation care robots that can address both safety and payload concerns through compliant mechanisms, sensor data and intelligent control. The inherent compliance enabled by such mobile care robots with continuum manipulators have great potential to provide physical assistance alongside professional caregivers in care settings. The project is strongly aligned with the UK government's industrial strategy to meet the healthcare requirements of the national ageing population and it addresses the societal need for affordable, sustainable, efficient and safe care service.

2. Project Scope

- **O1.** To develop an approach for the design and synthesis of large-scale continuum manipulators with programmable flexibility and stiffness.
- **O2.** To investigate actuation systems and various control modes of continuum limbs that allow both collaborative and active operations.
- **O3.** To integrate a mobile manipulator for operation in close or direct contact with both patients and care workers, assisting them with physical manipulation tasks.

3. Desired Skills from the Student

Key skills needed for the PhD project

- 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.

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: (**Ketao Zhang**, Lecturer in Robotics).

Secondary: (**Lorenzo Jamone**, Senior Lecture in Robotics and Computer Science, EECS).