SEMS: RESEARCH PROJECT DESCRIPTION

1. Project Background and Description

Innovative tactile and optical sensing and actuating robotic devices based on dielectric elastomer actuator (DEA) technology.

This project has two different pathways depending upon the student profile recruited.

The first path would develop a series of new materials with enhanced permittivity that allows greater articulation to be achieved in dielectric elastomer actuator devices without the need to use very high voltages. This work would look at how to measure how the permittivity of the device in situ to determine a detailed feedback about the deformed configuration. Thus allowing interactions with additional bodies which can be mapped in real time by touch.

The second path would develop a control system using Arduino and Voltage amplifiers to drive the DEA system and then a direct feedback from a measure in the change in relative permittivity in the system of the actual pressures and deformation that is being encountered as the device is actuated. This can be coupled to the existing systems to create a direct feedback of the structures that are being encountered as the DEA device explores its surroundings.

2. Project Scope

To extend the pioneering work in SEMS to create a range of dialectic elastomer actuators devices around haptics and optics.

To extend the pioneering work in SEMS to create a range of sensor devices built around piezo-resistivity.to working more closely with measurement based around permittivity as a way of mapping the interactions between a device and a second external body.

To develop the world's first coupled sensing and actuating device made using a dielectric elastomer actuator.

3. Desired Skills from the Student

Project Route 1 requires a good engineering design, materials or chemical engineering graduate (or equivalent) with knowledge of polymer materials and the ability to work with CAD facilities to create laser cutting paths or 3D printed devices whose material's properties are optimised.

Project Route 2 requires a good robotics or systems or electronic engineer or computer science graduate with a knowledge of how to program in a language such as MatLab to create systems that can control and measure the actuation of a range of devices and could create a system to deduce the shape of an external object from a mapping of the changes in the permittivity of a DEA device.

4. Supervisory Team

Prof. James Busfield – SEMS – j.busfield@qmul.ac.uk – Primary Supervisor

Dr Stoyan Smoukov – SEMS - s.smoukov@qmul.ac.uk

Prof Federico Carpi – University of Florence - federico.carpi@unifi.it (ex SEMS and long term collaborator)