# Mechanical Engineering Doctoral Defense

## Design and Modeling of Soft Curved Reconfigurable Anisotropic Mechanisms

School for Engineering of Matter, Transport and Energy

Yuhao Jiang
**Advisor:** Dr. Daniel Aukes

## Abstract

Soft robots are able to adapt to their local environment through active and passive shape change and can take on numerous configurations with large degrees of freedom. Traditional instantiations of soft robots are silicone-cast structures with pneumatic chambers to enable actuation and sensing. However, the actuation power is usually low and the actuator size is usually bulky, also the manufacturing of those casted structures usually takes a long time. Moreover, due to the non-linearity lies in the soft elastic materials and the complexity of the soft actuation systems, the dynamic modeling of the system is usually challenging and thus were not well utilized in most cases.

This dissertation focuses on the curved geometry of thin elastic structures, which, when manipulated, can result in local shape change and reconfiguration of mechanical properties. This concept can be leveraged to create a new type of soft system, which is referred to as Soft Curved Reconfigurable Anisotropic Mechanisms (SCRAMs). By studying the stiffness behavior and the shape change behavior of the soft curved surfaces, various SCRAM devices can be developed to accomplish different locomotions with fewer actuation and control inputs.

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