Project Title: Flexible/Stretchable Actuation of Shape Morphing 3D Lattice Structures

3D lattice structures are cellular solids with low relative densities architectured in a pre-designed network of struts, beams and other structural elements. They are known to offer reinforced and optimized properties when compared to its parent material. Introducing flexibility/stretchability features has offered significant reaction forces while experiencing large dimensional changes. Currently, one of the major research concerns is to enhance the stress-strain behavior during actuation under external field/stimuli. Such stimuli can dictate the intended mode of actuation like shape memory polymers, auxetic designs and other stimuli-responsive structures, tailored by optimizing the distribution, shape and size of the 3D unit lattice cells. The project aims to produce enhanced functionality of flexible/stretchable structures with shape-matching, shape-morphing and compliance matching by careful consideration of surface textured designs, material selection and impregnation types for designed stimuli responsive functions. The work is aimed to potentially enhancing grasping functions in soft robotics, design of texted footwear for enhanced ergonomics and anti-slippage and programmable/multicable stiffness or deployable, morphing structures.

Project Deliverables:

Produce parts with shape morphing and stimuli responsive properties with stretchable/flexible material architectures. The prototype should be able to utilize 3D printing technologies (preferably Stereolithography) in order to mix 3d printing materials with other additives (examples are magnetic particles or thermal responsive chemical components) in order to observe the shape morphing capabilities after 3d printing.