Project Title: Resilient and Adaptive Wheels with 3D Cellular Lattice Structures

A wheel is an extremely vital element of motion involved in automotive, aerospace, transportation and robotics. A solid design of a wheel causes issues regarding material cost, higher weights and simpler response (similar to parent material). This has implication to keeping the wheels on the ground with unfavorable traction and shock absorption. As such, designs of spokes are critical towards the strength of the wheel, where it has received a large interest from relevant industrial parties. 3D architectured cellular solids offers a great opportunity to include higher resilience, adaptivity and shape morphing to vehicular wheels for pre-defined terrains. 3D lattice structures can be random, uniform, conformal or functionally graded to serve the purpose of the designer's specifications. A more uniform distribution of load for the spokes can be realized by means of cellular structures, while a higher modulus structure per unit weight than the parent material provides a longevity and reliability exceeding those of conventional wheel designs. Applications of interest include puncture-free wheels, robotic terrain motion and stair-climbing features for persons who are suffering from accessibility/disability issues.

Project Deliverables:

Investigation of possible candidates of cellular lattice spokes for puncture-free wheels and electrical design on vibrational readings for shock absorption and suspension from obstacles.