Multi-Section Pneumatic Artificial Muscle Continuum Robot Arm with Ossicle-inspired Structures

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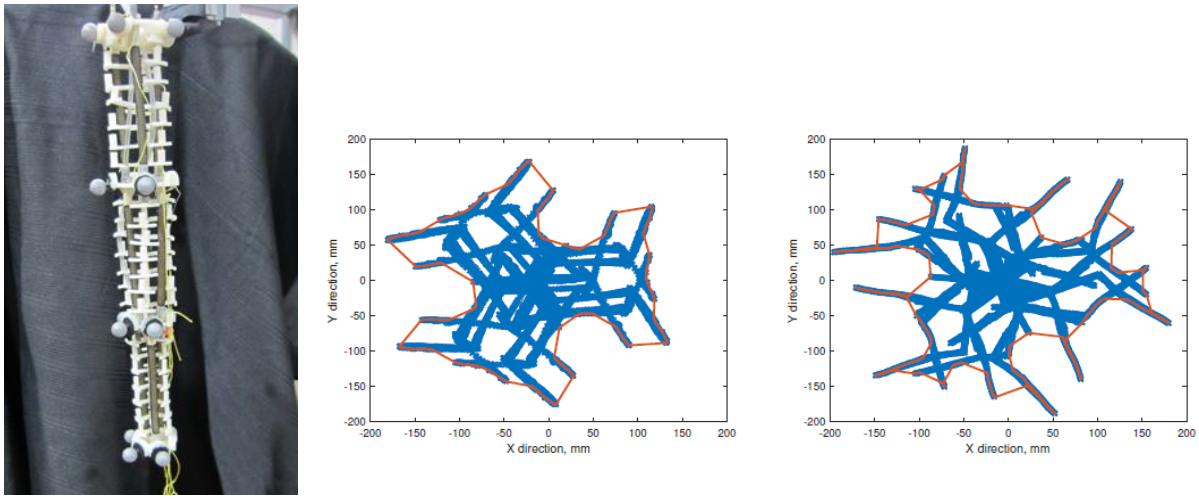
ABSTRACT

Continuum robotic manipulators are those which continuously bend to interact with unexpected objects in various orientations. These robots are typically extensions of hyper-redundant robot and more recently being built completely soft material, soft robots. Hyper-redundant robots by definition have a large number of joints and actuators, leading to heavy designs. Conversely, soft robots attempt to overcome this limitation, by using lightweight, low stiffness materials which deform to eliminate joints. The downside of these low stiffness materials, is a reduction in load capacity of these manipulator. This work studies a three section pneumatic artificial muscles actuated manipulator. PAMs were chosen for their high force and stroke behavior. The arm is compared with a second version achieved by adding an ossicle-inspired structure similar to those found in the arms of sea-stars, with the goal of increasing the load capability of a multi-section pneumatic artificial muscle actuated manipulator. This work considers the planar projection of the workspace of the manipulator with and without ossicles. The pneumatic muscles are actuated in various loading conditions to determine the impact of load on the position of the end of the manipulator. With ossicles there is a benefit to the load carrying capability without sacrificing no load performance.



a) b) c)

Figure 1. a) Three section PAM arm with ossicles. b) Projected workspace without ossicles and no load. c) Projected workspace with ossicles and no load.