Design of Surgical End Effectors for Robotic Parallel Continuum Manipulators

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Continuously flexible robotic manipulators have the potential to improve minimally invasive surgical procedures. We are exploring a continuum manipulator that has six continuously flexible legs arranged in a parallel platform arrangement to achieve higher precision, cost effective construction, and ease of miniaturization. For this manipulator to be successfully applied to minimally invasive surgery, small surgical tools that are compatible with parallel continuum robots are needed. We aim to design a tool that is cable driven to minimize mass at the tip of the robot. Using flexible tubes for the six legs of the parallel continuum manipulator allows cables to be routed through the legs, which provides the actuation mechanism for a cable driven end effector. Several two degree-of-freedom surgical tools with 12 mm diameters have been designed and successfully rapid-prototyped and assembled. Future work includes testing and implementing the tools on a full mechatronic system, investigating robotic end effector control methods, and increasing degrees of freedom in the end effector.