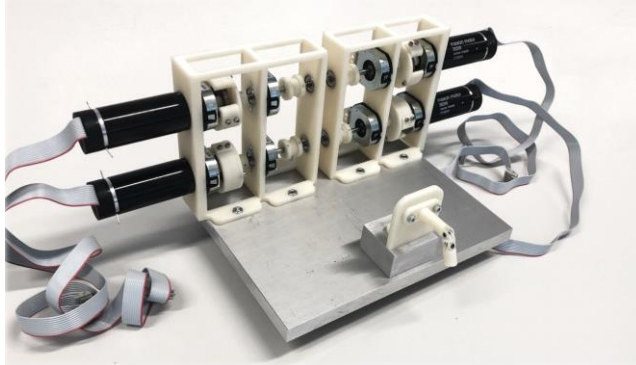
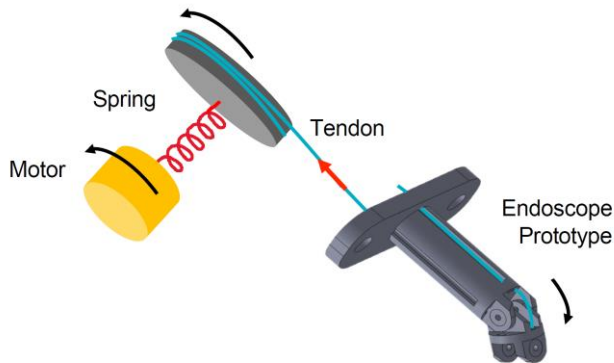


Design of Series Elastic Actuation for a Cable-Driven Articulated Endoscope

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Semester Thesis



A proof-of-concept endoscope prototype with series elastic actuation was built. (Image: Sara Pensotti)



Series elastic actuation is a concept where a spring is placed in a mechanical system between the motor and the moving part, in this case the tendon-driven endoscope. (Image: Sara Pensotti)

Robotics have been more and more present in surgeries in the past years. Often, the surgical robots are tele-manipulated by the surgeon, i.e., the surgeon is controlling the robot from a mechanically decoupled console. As a result, the surgeon does not feel the interaction between the surgical tools and the tissue. This can be unintuitive and even dangerous in some situations. To counteract this, placing a spring in the motion transmission of the robot could lower the contact forces. Furthermore, information of the contact force between the endoscope and its surrounding tissue could be obtained by measuring the deflection of the spring. This actuation concept is known from other fields of robotics as “series elastic actuation”.

In this semester thesis, a proof-of-concept endoscope prototype with series elastic actuation was built. After an initial concept phase, the stiffness of the spring was chosen based on surgical requirements, and the prototype was designed, manufactured and assembled. A control algorithm was implemented that consisted of combined force and position control.

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