Robotic Rehabilitation: Soft Actuators

Background
The debilitating effects on hand function from a number of neurologic disorders has given rise to the development of rehabilitative robotic devices aimed at restoring hand function in patients. For the majority of the cases of chronic stroke with hemiparesis, loss of hand motor ability is observed. This can greatly inhibit activities of daily living and considerably reduce the quality of life. Improving hand function requires repetitive task practice rehabilitation, which involves individual movements and practicing these exercises (typically with an occupational therapist) to improve hand strength, accuracy, and range of motion. These methods, however, are labor intensive, costly, and slow, often leading to challenges with patient compliance. A system where patients can carry out exercises on their own, at home or in the clinic, would make physical therapy more accessible, affordable, increasing the potential for better outcomes. To combat the shortcomings of previous traditional robotics, e.g., rigid exoskeletons, soft robotics are rapidly emerging as an alternative due to their inherent safety, less complex designs, and increased potential for portability and efficacy. Novel soft robotic gloves leverage soft material actuator technology to safely distribute forces along the length of the finger and provide active flexion and passive extension. Usually, these actuators consist of molded elastomeric bladders with anisotropic fiber reinforcements that produce specific bending, twisting, and extending trajectories upon fluid pressurization.

Problem and goal
The study of different technologies and methodologies to produce a portable, assistive, soft robotic actuator designed to improve hand rehabilitation for individuals with grasp illness. This problem can be divided in the following tasks:

- Survey of the different technologies of soft actuators adequate for this problem.
- Design and development of a soft actuator capable to individually control multiple joints.
- Design and development of an electronic control unit to command the soft actuator’s motion.
- Validate the system in a simple scenario.

Målgrupp: TKAUT, TKDAT, TKTFY, TKELT, TKTEM, TKMAS, TKITE

Gruppstorlek: 3–6 students

Antal grupper: 1

Förkunskapskrav: Designing mechanical systems, designing and building electrical circuits, basics on computer programming and control.
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