Investigating Dynamic Control of Strapping Pressure for Active Physical Interfaces

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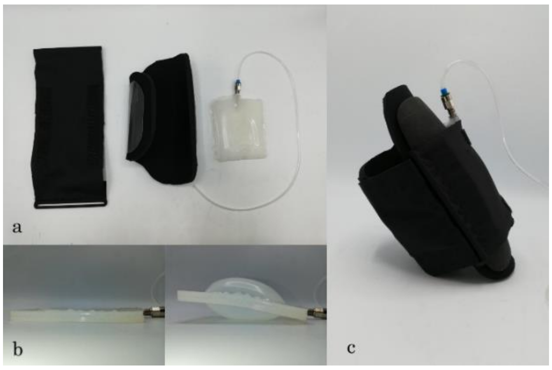
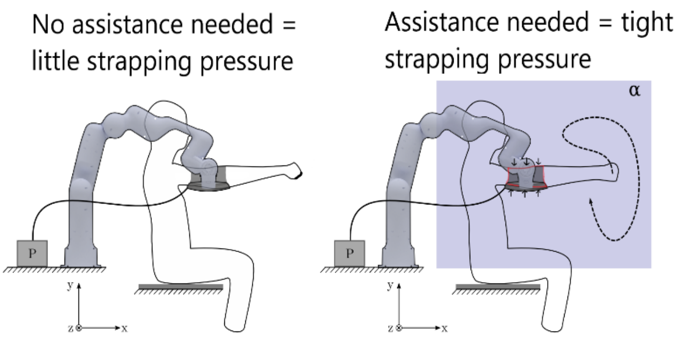
In recent years, wearable robots and exoskeletons have gained significant attention for their potential to assist in various applications such as rehabilitation, power augmentation, and assistance. However, there is always a compromise to make between making the exoskeleton comfortable while at the same time providing efficiently the assistance needed to perform a motion. To address this issue, automatic controlled strapping pressure have been proposed to adjust the strapping pressure based on the user's intention. In this approach, the system applies a tight strapping when the robot is providing assistance to the user and moderate strapping when the robot is providing little assistance. This can provide an optimal balance between low forces and sufficient force transmission, ultimately leading to a more comfortable and safe wearable robot or exoskeleton experience for the user.





As a thesis student, your goal will be to investigate an active physical interface's advantages over a passive interface by controlling it. Firstly, you will study the attachment arrangement to determine if a single chamber is sufficient to hold the user's limb. Next, you will devise a control strategy to vary the strapping pressure based on the user's intention, using mechanical (Inertial Measurement Unit) or physiological sensors (EMG sensor). A human trial will be conducted with a healthy subject using a commercial torque-controlled cobot or exoskeleton to determine the best attachment arrangement. Performance measurement will be done using the Franka Emika cobot and Vicon motion capture system, and perceived comfort will be assessed through subjective methods such as the VAS score.

Your task : Investigating the spatial and temporal arrangement of the pneumatic chamber, devising a control pressure strategy for dynamically changing strapping pressure, and implementing the final prototype on a healthy human subject.

Requirements : Self-motivated, CAD design (Inventor/Solidworks), programming (Arduino, Python), Simulation and control (Simulink); data processing (Matlab).

Please contact us for more information before choosing the project.