Omni-usability Soft Robotic Exoskeleton (OSRE)

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Introduction

The goal of the Omni-usability Soft Robotic Exoskeleton (OSRE) is to create a safe, modular exoskeleton platform using McKibben soft robotic muscles.

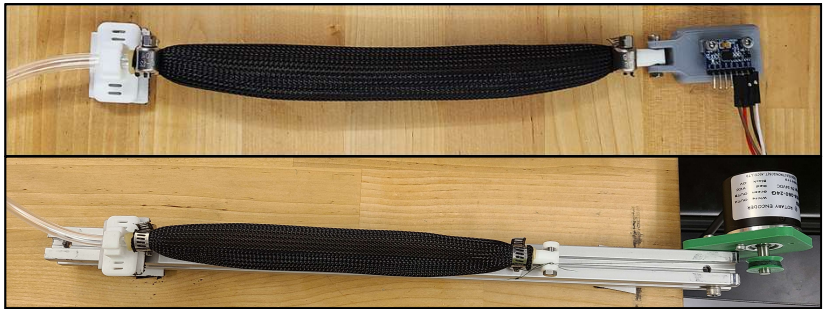

Figure 1: McKibben pneumatic muscle test stands to collect positional and acceleration data

Objectives

- Design a full-body soft robotic exoskeleton platform using McKibben muscles
- Utilize electromyography data and live positional data to allow the OSRE platform to act in either an assistive or resistive role

Methods

- The use of Proportional-Integral–Derivative controllers (PIDs) and Inertial Measurement Units (IMU) allows us to stabilize the movement of the muscles
- Electromyography data will be used to compare the expected and actual movement of the platform using IMUs and PIDs
- For safety purposes, the OSRE platform will operate between 10 and 60 PSI.

Figure 2: Prototype of the OSRE arm

Progress

As of now, our current project on the OSRE platform is as followed:

- Derivation of flow-rate function to control the input of air into the muscles
- Construction of a functioning prototype arm to study motion and refine code
- Motion through preset timings to move the arm along a precalculated route

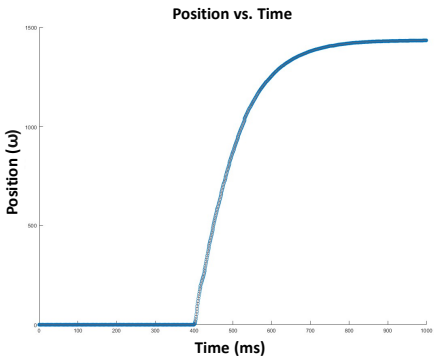

Figure 3: Position of a McKibben muscles position relative to time

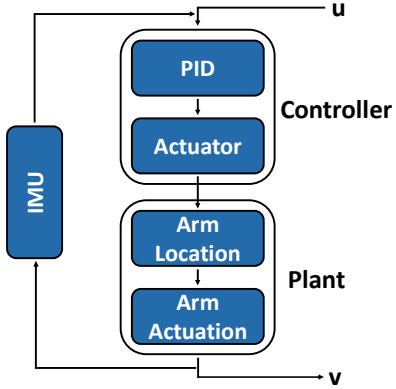

Figure 4: Flow chart of IMU and PID positional checking of the system

Conclusions & Future Work

This research can be further implemented into autonomous systems to aid and enhance the dynamic flexibility under severe weight restrictions. The OSRE platform and its closed pneumatic system is a unique alternative to existing robotic appendages. This can be applied for space applications to preserve launch mass without compromising functionality. This reduction allows for additional scientific instruments to be transported by a launch vehicle into orbit.

Acknowledgments

IGNITE, Office of Undergraduate Research
Dr. John French – ERAU Electromyography Lab