Aufgabenbeschreibung

Institut für Medizingerätetechnik

Masterarbeit /Studienarbeit

Soft Robotic Ankle Orthosis

The Institut für Medizingerätetechnik is investigating a project for a soft robotic ankle orthosis. Recurrent ankle sprains, in which the tendons around the joint are stretched beyond their physiological length and irreversible deformity ensues, are highly likely to cause Chronic Ankle Instability (CAI): a long-term condition. Ankle sprains can develop when a rapid inversion or eversion occurs as a consequence of unexpected lateral ankle buckling, causing undue stress to the tendons. The most common lateral ankle joint injury is a lateral ankle sprain, which is caused by inversion stress to the joint. Most ankle-foot orthoses (AFOs) are composed of stiff, lightweight polymers that passively impart stiffness to the ankle joint to aid balance and avoid lateral ankle buckling. Rigid AFOs limit ankle motion and fix the joint at a neutral angle, which might lead to mobility problems, a higher risk of injury, or discomfort owing to gait adaptations caused by decreased ankle function. This project is focused on presenting a soft robotic ankle orthosis that uses fabricated pneumatic actuators to eliminate the issue of rigid and limited ankle support. It assists the human ankle in inversion-eversion (IE) ankle support in the frontal plane without limiting ordinary movement in the sagittal plane.

Below there are some previous AFOs:

Fig.1. Figure 1: (a) Individually designed hinged ankle-foot orthoses (DAFO), (b) Carbon composite ankle-foot orthoses (C-AFO).

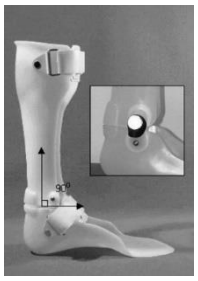

Fig.2. Example of the custom-molded, polypropylene, articulated AFO with 90° plantar flexion stop, free dorsiflexion, and full-length foot-plate.

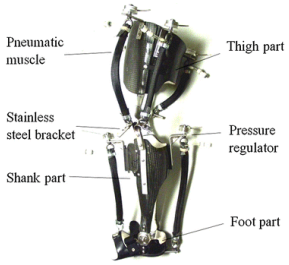

Fig.3. Sawicki, G. S., and D. P. Ferris. A pneumatically powered knee–ankle–foot orthosis with myoelectric activation and inhibition. J Neuroeng Rehabil. 6:23–38, 2009.

Below you will find the aim of your thesis:

- to model and characterize a hollow cylindrical and inflatable fabric-based actuator.
- to design and conceptualize the mechanics and electronics integration.
- to evaluate and test the soft robotic ankle orthosis.

The following requirements would be ideal for the prospective student:

- basic knowledge in programming microcontrollers
- basic knowledge of CAD (Creo Parametric preferably)
- basic knowledge of manufacturing processes
- basic knowledge of mechatronics

Supervision will be provided in English. Hence, the thesis should be written in English.

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