LEAD ORGANIZATION: Lockheed Martin

PROJECT: Flexible Skin Sensing to Control a Soft Robotic Knee Exoskeleton

ABSTRACT

Conventional solutions for physical human augmentation, such as the powered rigid-body orthoses used in clinical rehabilitation and the cable-driven harnesses used for able-bodied locomotion assistance, are challenging to implement in practice due to mechanical encumbrance (e.g. device mass, stress on soft tissues) and poor device adaptation to users' physiological states (e.g. fatigue, levels in exertion). For this reason, the impact and proliferation of such devices in industry and healthcare have been limited. In this proposal, Georgia Tech and Lockheed Martin aim to address this issue by developing a soft robotic knee exoskeleton which is controlled using feedback from novel epidermal FHE sensors (ultra-thin, flexible, stretchable sensors mounted to the user's skin) and is mechanically-driven by soft, lightweight, pneumatic actuators which provide safe, controllable force output. Several key technical innovations will be made during the development of the proposed exoskeleton, including multi-modal epidermal FHE sensors and control algorithms, soft sensor-embedded pneumatic actuator arrays and power systems, and soft thermal and pressure regulation units for user comfort. A key focus during this development will be enabling scalable manufacturing and integration of the soft exoskeleton components.