

# Design of a Low-Pressure Pneumatically Actuated Soft Robotic Glove to Facilitate Bilateral Training in Stroke Rehabilitation

Fadi Gerges

Faculty: Jaydip Desai

*Department of Biomedical Engineering, College of Engineering*

Stroke is one of the leading causes of long-term disability worldwide. As a result of this injury, many stroke survivors will experience some degree of paralysis immediately after the injury, such as lost hand motor function. Throughout the last decade, researchers have been working on improving existing rehabilitation techniques and assistive hand exoskeleton technologies to encourage a faster motor function recovery to those patients who lost hand motor functions. However, many clinics still rely on old rehabilitative rigid hand exoskeleton, which is not very effective during the recovery of the patient. This paper proposes a design of a low pressure soft robotic glove as an assistive device to facilitate bilateral hand training during stroke rehabilitation. In the bilateral hand training therapy, a movement in the healthy hand generates a similar movement in the parietal hand through the robotic glove. Researchers found that the activation of both cerebral hemispheres in rehabilitation exercises improves outcomes significantly. In order to create the robotic glove, a design of soft actuators that are pneumatically actuated and can achieve high flexion forces is proposed. The mechanical performance of the actuator was analyzed based on its blocked tip force capabilities and its capability in supporting the full range of motion of the fingers. The current actuator prototype is capable of producing 9.5 N force at the fingertip when pressurized to 99.5 kPa, which is enough to assist the parietal hand in performing rehabilitation exercises. Then, a master-slave controller is proposed to facilitate bilateral hand training such that a glove (master) with flex sensors is used to detect a movement in the healthy hand and use this information to generate a similar movement on the soft robotic glove that is worn on the parietal hand. The glove was successful in meeting the design requirements and in assisting a healthy patient in performing a pinch, tripod pinch, and full grasp movements.