Indo/US Collaborative Research Grants

National Science Foundation of US and Technology Innovation Hubs of India

Title: Development of a Soft Elastomeric Finger Exoskeleton with Embedded Discretely Variable Stiffness Structure for Multi-type and Multi-stage Hand Rehabilitation

Indian PI: Prof. Soumen Sen, Professor and PI in the grand project on collaborative robotics for rehabilitation in the I-Hub Foundation for Cobotics (IHFC), India.

US PIs: Prof. Dongming Gan, Prof. George Chiu, Prof. Richard Voyles, Purdue University, West Lafayette, IN, US.

Hand motor function impairment is one of the most common problems due to stroke or injuries which affects patients' daily life activities. Robotic devices provide repetitive functions and accurate measurement to assist therapists and speed rehabilitation. Soft robotics exoskeletons bring great advantages in rehabilitation with customizable motion, high power to weight ratio, safe interaction and low cost. However, human hands are complex and highly varied with diverse needs for rehabilitation. There is a lack of a systematic approach for designing reconfigurable hand exoskeletons to adapt to varied finger geometries and stiffness requirements in progressive rehabilitation stages. To fill this research gap, the collaborative project aims to develop a soft finger exoskeleton concept that could be reconfigured for multi-type and multi-stage hand rehabilitation and assistance. **The core novelty lies in the combination of the hyper-elastic elastomer based soft actuation system (IHFC India) with embedded discrete variable stiffness mechanisms (Purdue) to result in a new soft, pneumatic exoskeleton for hand rehabilitation from the fusing of the two research efforts.** The soft nature of the design requires localized variable stiffness mechanisms to adapt to different finger shapes and motions, which is an ideal extension of both the current NSF project focusing on discrete variable stiffness units and the I-Hub Foundation for Cobotics (IHFC) grand challenge project on soft actuation systems for exoskeleton-based rehabilitation.