Abstract

Today, over 15 million people must live with upper-limb amputations. Of these people, nearly 85 percent lack the economic means or resources necessary to gain access to functional prosthetic technology (Gilja et al). The purpose of this study is to utilize granular jamming in order to develop versatile, low-cost upper-limb prostheses targeted at under-privileged amputees in developing countries. However, the design also considered potential applications in developed countries, where many existing prostheses are still limited in their range of gripping abilities (Anfolk et al). The main component of the device is a granular jamming gripper, which consists of a granular mass encased in an elastic membrane. The gripper conforms to the shape of an object, applies negative pressure to vacuum-harden and grasp, and then, after a valve manually reverses the transition, releases the object. The negative pressure is controlled by a glove worn on the opposite hand featuring two aluminum plates which, when put in contact, connect the motor to power and allow the gripper to vacuum-harden. The device displays a battery level detector which warns the user when the 12V battery's state of charge decreases below 12.64V, providing the user with adequate notice to recharge the power supply before compromising device functionality. The current design is able to successfully grasp and release a wide range of objects that are typically difficult for conventional single-cable prostheses to grasp, including flat, smooth, and geometrically complex objects (Anfolk et al). The Granular Jamming Prosthetic currently has a patent pending and prototypes have been shipped to Kerala, India for ongoing field testing and integration.