



A Cosmetic Prosthetic Digit with Bioinspired Embedded Touch Feedback

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Abstract

Partial hand amputation is the most frequent amputation level worldwide, accounting for approximately 90% of all upper limb amputations. Passive cosmetic prostheses represent one of the possible choices for its treatment, probably the most affordable one. However, these devices restore very limited motor function and subtle sensory feedback. The latter is an important component for restoring the body schema. In this work we present a simple yet potentially effective and low cost cosmetic digital prosthesis that embeds touch feedback; we dubbed this DESC-finger. It delivers short-lasting vibrotactile bursts when it makes and breaks contact with the environment, based on the Discrete Event-driven Sensory feedback Control (DESC) policy. One prototype was developed and used by one amputee at home, for two months. The effectiveness of the device was experimentally assessed by means of an interview and a virtual eggs test, which showed, albeit preliminarily, that time discrete feedback can improve the motor control of a partial hand prosthesis in daily life conditions. Besides targeting people that already use cosmetic digits, the DESC-finger targets those that do not use them complaining for loss of sensibility. The production costs and manufacturing process makes the DESC-finger suitable for exploitation in high- and low-income countries.