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Tactile perception of textile surfaces from an artificial finger instrumented by a polymeric optical fibre

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Abstract

This study aims at designing an instrumented artificial finger able to reproduce friction behaviour with textile surfaces. The developed artificial finger was based on a polymeric optical fibre sensor inside a polydimethylsiloxane core and an external layer with a texture similar to a fingerprint. The results obtained with textile surfaces show a good correlation with the human finger in terms of the coefficient of friction and perception of the sliding direction. The signal obtained is a combination of normal and friction forces. Therefore, like a real finger, this artificial finger is sensitive to both shear and compression.

Keywords: Artificial finger, polymeric optical fibre, textile, tactile.

1. Introduction

Tactile comprehension of our world is one of the capabilities of human beings that is most taken for granted. Transposing this function to a technological device is not a trivial matter. Tactile description of surfaces requires a specific interface sensor able to transmit the information needed for the due description. Information obtained through a human finger is vast and applied to various fields. During touch, the finger receives information through heat exchanges, deformation of the pulp due to friction forces, and vibration due to irregularities of the surface in terms of the roughness or physico-chemical composition, as explained in [1, 2]. A finger possesses four kind of mechanoreceptors in the glabrous skin which composes the finger pads: the Meissner corpuscles located in the immediate proximity of the epidermal skin section, the Pacinian corpuscles, located more deeply in the dermal part of the skin, which are