

MISLEADING TACTILE PERCEPTION BY VIBROTACTILE RENDERING

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ABSTRACT

The sense of touch represents one of the channels, the five senses, through which the human being feels the external environment. Differently from sight and hearing senses, touch needs direct physical interaction between the body parts and the perceived object. From the interaction between the skin and the surface, various tactile stimuli (such as forces, vibrations, temperature, etc.) are generated and detected by different classes of mechanoreceptors, transduced into electrical signals, and sent by the nerves to the brain, where they are decoded. Understanding the complex phenomena occurring at the finger/surface contact during the tactile exploration is thus essential. One of the lines of research in biotribology is investigating the role of Friction-Induced Vibrations (FIV) stimuli in mediating between the surface textures and their perception and discrimination. Efforts are being done as well to render the tactile feeling of textures at distance by mimicking mechanical stimuli with tactile devices of any sort [1], [2], [3].

Recent works [1], [4], [5] dealt with the development of a tactile rendering device, named Piezotact, able to reproduce the vibrational stimuli, previously measured during the exploration of real textures, by a piezoelectric actuator with a specific rendering methodology. In these works, different key features of FIV have been found to be correlated with the discrimination of periodic and isotropic textures, respectively the FIV frequency distribution and the FIV amplitude.

In the current work, starting from the results of [1], [4], [5], the Piezotact tactile device has been exploited to alter specific features of the FIV signal to construct fake textures to deepen the understanding of the relationship between such FIV features and the perception. As an example, discrimination campaigns (Fig. 1) have been conducted on panels of volunteers when modifying specific features of the FIV stimuli, measured on real texture, to render them by the device, with the goal of evaluating if the subjects were induced to mislead the discrimination of the surfaces consistently with the FIV feature

modifications.

Fig.1 Discrimination test on rendered textures by the Piezotact tactile device



The results of the discrimination campaigns corroborated the hypothesis, confirming the role of the investigated FIV features in the discrimination of textures.

Moreover, the presented innovative approach put in light how useful can be a tactile device, such as the Piezotact, in order to simulate or even creating vibration stimuli, in order to mimic tactile perception.

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