Wearable Mechatronics for Receiving and Transmitting Information Through the Skin

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The rich set of mechanoreceptors found in human skin offers a versatile engineering interface for transmitting information and eliciting perceptions, potentially serving a broad range of applications in patient care. Targeted multisensory engagement of these afferent units, however, faces persistent challenges, especially for wearable, programmable systems that need to operate adaptively across the body. We present a miniaturized electromechanical structure that, when combined with skin as an elastic, energy storing element, supports bistable, self-sensing modes of deformation. Targeting specific classes of mechanoreceptors as the basis for distinct, programmed sensory responses, this haptic unit can deliver both dynamic and static stimuli, directed as either normal or shear forces. A wireless, skin-conformable haptic interface, integrating an array of these bistable transducers, serves as a high-density channel capable of rendering input from smartphone-based 3D scanning and inertial sensors. Demonstrations of this system include clinical trials for patients with stroke and spinal cord injury [1,2].

References

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2. Shin, J., Song, J.W., Flavin, M.T. *et al.* A non-contact wearable device for monitoring epidermal molecular flux. *Nature* **640**, 375–383 (2025).