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2-DoF Wearable Fingertip Cutaneous Display

Wearability opens up a whole new world of opportunities in haptic systems for novel communication forms and interactions with the external environment. Wearable fingertip haptic systems are particularly interesting as they offer a natural interface to one of the most fundamental senses, touch. There are several types of cutaneous fingertip devices which provide one or more types of skin stimulation. In some devices, slanted compressive forces are utilized; however, they tend to have complicated manufacturing processes, limited types of forces that can be applied, and are not easily wearable or portable. Other devices are limited in the maximum degree of force provided and as such cannot provide compressive and shear forces upon the same area in a simple design, limiting functionality and increasing cost. More advanced wearable devices would allow for greater comprehensive and controllable fingertip stimulation.

Prof. Marco Santello at Arizona State University and his collaborators at the University of New Mexico and the University of Siena have developed wearable fingertip devices having two degrees-of-freedom (DoF). This technology is capable of providing compressive force and/or shear force to a fingertip for controllable fingertip stimulation. This system provides tactile information relevant to the user, so that the user is able to interact with virtual objects, without any complex setup process. Compressive forces of up to 4.5 N and shear forces of up to 4 N can be provided with this device, increasing functionality.

These simple to assemble, wearable devices provide controllable fingertip stimulation to accurately render a virtual contact and could be beneficial in rehabilitation, research, gaming, and so much more.

Potential Applications

- Wearable fingertip devices
  - Controllable fingertip stimulation
  - Rehabilitation -e.g. hand grasping
  - Research - studying neuroscience on human perception
- Gaming - tactile feedback for enhanced virtual interaction
- Commercial force feedback devices

- GPS navigation systems
- Teleoperators and simulators
- Mobile devices
- Virtual reality technology

Benefits and Advantages

- Portable, simple to assemble and easily wearable
- Can provide information about a computer interface or suggest directional cues to the operator of a computer, car, or various portable devices
- Can provide touch feedback in applications where audible or voice cues are given
- Reduces cognitive load by providing a conduit for communicating spatial and/or directional information
- Exhibits low overall power requirements for operation
- Presents a wide range of force magnitudes