

Towards Soft Robotic Skin and Smart Textiles: Shear Tactile Displays with Soft Actuators

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Motivation

- Humans are tactile beings
 - We're very good at interacting through touch and getting information through touch.
- Want to make devices that interact with us through touch i.e. tactile displays
 - Current technology mainly relies on the visual domain (screen) and the the auditory domain (speakers).
- We need new actuator technologies, new design ideas
 - Existing tactile displays such as refreshable braille displays are expensive, fragile, big and bulky
 - Cannot readily fabricate large arrays of conventional actuators, we require new technologies with lower mechanical complexity.



http://upload.wikimedia.org/wikipedia/commons/0/06/Refreshable_Braille_display.jpg

What we want to do

- Tactile display with soft actuators
 - Use smart soft shape-changing actuators with inherent compliance, such as Dielectric Elastomer Actuators (DEAs).
- Entire device can be soft and compliant
- Wearable technology
 - Soft devices are ideally suited for wearable technology such as smart textiles and smartwatches. A soft device will be more comfortable to wear, and will be able to move with the body.
- Self-sensing
 - DEAs are capable of sensing as well as actuation, creating the opportunity for devices functioning as tactile displays and tactile sensors simultaneously.

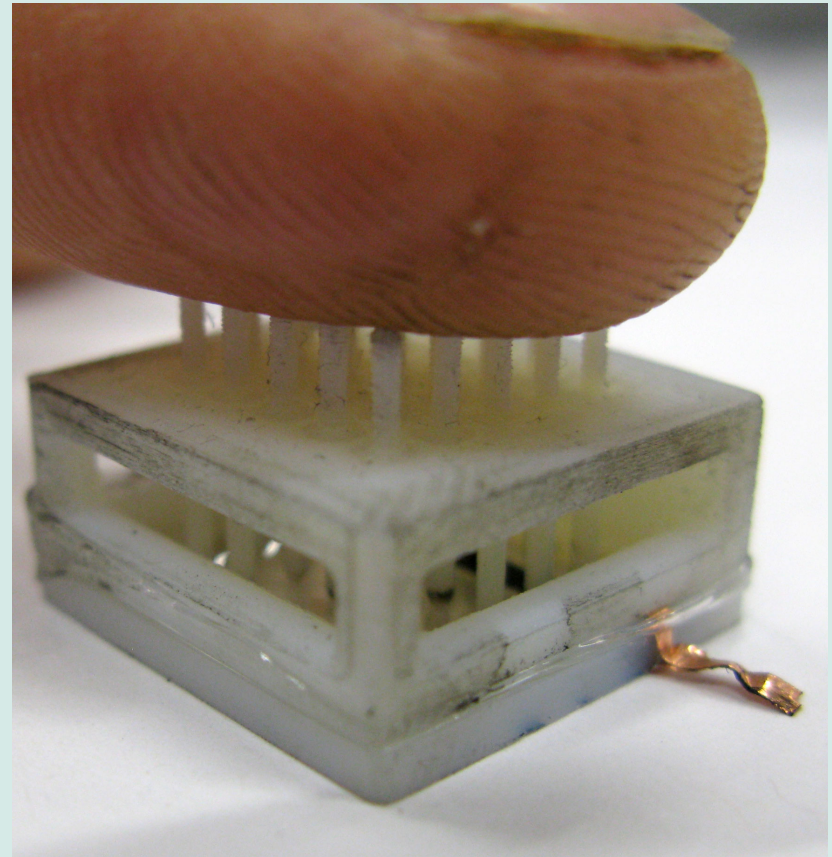


<http://www.sonymobile.com/gb/products/accessories/smartwatch/>

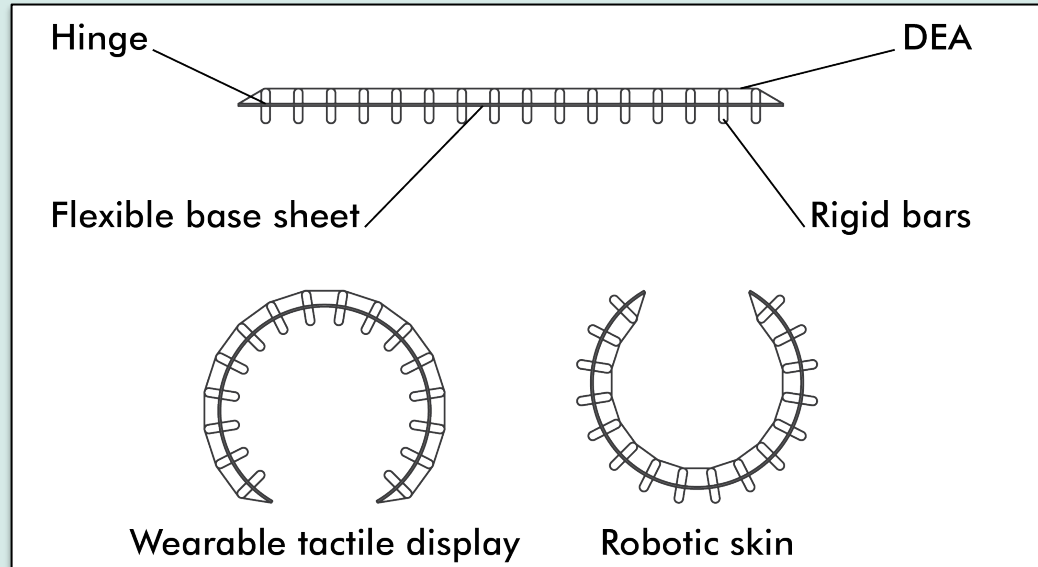
Our design

- Prototype unit: soft actuator, rigid frame
- Fabricated on multi-material 3D printer; hard and soft elements
- Shear tactile stimulation
 - Pins move laterally against skin and create shear forces
- Preliminary tests show that device generates a strong tactile sensation.
- See [1] for details.

[1] Lars E. Knoop ; Jonathan Rossiter; Towards shear tactile displays with DEAs. Proc. SPIE 9056, Electroactive Polymer Actuators and Devices (EAPAD) 2014, doi:10.1117/12.2044572.



Future work



We are developing a new version of the display with a flexible base sheet, suitable for wearable devices. A further application of the device could be soft robotic skin, so that the robot would be able to feel if a person touched it, but the person would also get some tactile feedback from the robot e.g. about the state of the robot or the current danger level.