Soft Shear Force Resistive Sensor Embedded Artificial Skin

Tech ID: 30596 / UC Case 2017-841-0

SUMMARY

UCLA researchers in the Department of Mechanical and Aerospace Engineering have developed a bioinspired, thin and flexible liquid metal filled resistive PDMS microchannel shear force sensing skin.

BACKGROUND

Tactile sensing is important for haptic exploration and object manipulation; however, it is not yet widely implemented in robot hands or prostheses. Spatially and temporally resolved normal and shear stresses are critical mechanical measurements that need to be resolved on artificial fingertips.

INNOVATION

The inventors have developed a shear sensing artificial skin using bioinspired, thin and flexible liquid metal filled resistive microchannels. The PDMS based sensor skin is wrapped around a finger-shaped effector and fixed at the location of the nail bed. When the skin is subjected to shear force it results in one side of the skin in tension and the other side in compression that buckles and bulges similar to a human fingertip. The tension and compression are measured by embedded liquid metal strain gauges adjacent to the nail bed, away from the point of finger-object contact. The sensing philosophy can be expanded to provide spatially resolved tactile information and correlations can be acquired via machine learning processes.

APPLICATIONS

- Prosthetic and robotic applications
- Artificial skin

ADVANTAGES

- Responsive to slow and fast stimuli (e.g. vibration)
- Large dynamic range that is insensitive to the applied normal force over a range of shear forces
- Intrinsically flexible and immune to fatigue when subjected to repeated large strains
- Sensing taxels are located away from contact area of fingerpad, leaving room for other sensing taxels for other modalities (e.g. normal force)
- Design possibilities of integration

RELATED MATERIALS

- Yin, J., Santos, V.J., and Posner, J.D., “Bioinspired flexible microfluidic shear force sensor skin,” Sensors and Actuators A: Physical 2017:264:289-297. doi.org/10.1016/j.sna.2017.08.001
- Yin, J., Aspinall, P., Santos, V.J., and Posner, J.D. “Measuring dynamic shear force and vibration with a bioinspired tactile sensor skin,” IEEE Sensors 2018:18(9):3544-3553.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,199,460	12/14/2021	2017-841

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Tendon-Driven Actuation Module for Robotic Hands

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OTHER INFORMATION

KEYWORDS

resistive sensor, conductive fluid, flexible, shear force, artificial skin, soft lithography

CATEGORIZED AS

- **Sensors & Instrumentation**
  - Other
- **Engineering**
  - Robotics and Automation

RELATED CASES

2017-841-0

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