Docket #: S25-353

Capacitive Array with Differential Stiffness Regions for Modulus Identification

Stanford researchers have developed a soft, stretchable tactile sensor array that can detect differences in the softness or stiffness of objects. The technology could help robotic systems, prosthetics, and surgical tools better "feel" and identify materials, tissues, or objects. Robots, prosthetics, and surgical tools still struggle to replicate the human sense of touch, especially when distinguishing between soft and firm materials. Existing tactile sensors often rely on resistive components that can be difficult to scale, complex to wire, and prone to signal drift. This invention has a passive capacitive sensor array that measures both pressure and deformation to estimate the stiffness of a touched object. The sensor design can be customized in size and layout, making it adaptable for robotic hands, bionic prosthetics, surgical instruments, and automated manufacturing systems. This approach could enable more scalable and reliable tactile sensing for applications that require object recognition, tissue differentiation, or human-like touch feedback.

Stage of Development: Proof of concept

Applications

- Tumor detection via palpation
- Robotic surgery touch feedback
- Prosthetic electronic skin
- Humanoid and industrial robot tactile sensing
- Automated produce and object grading
- Wearable softness-sensing devices

Advantages

- Scalable, single-mechanism capacitive sensing
- Customizable taxel size and array layout
- Reduced drift compared to piezoresistive sensors
- Streamlined fabrication and data acquisition
- Stretchable, wearable form factor

Publications

- Berman, A., Shi, B., Zaluska, T. et al. A skin-inspired, capacitive array for tactile modulus detection via a scalable rigid-island architecture. *npj Flex Electron* 10, 5 (2026).

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