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Abstract
There existed handful of commercially available tactile sensors. However, most of the sensors are large, cumbersome and provide mainly pressure sensing. The purpose of this study is to design a polymeric sensor capable of measuring both directions and magnitudes of the applied force. Potential applications are in medical, dental, sports, robotic, civil and infrastructure etc.
The basic concept of measuring pressure and shear forces is to utilize a polymeric capacitor array. A design of a sandwich structure consists of an array of capacitors where capacitors are made of two flexible metal electrodes supported by two thin elastomer substrates and separated by a thin silicone gel. A force induction on the capacitors causes the capacitors' gap space and area coverage to change. Both pressure and shear can then be derived based on the changes in the capacitors by using a simple summation and differentiation of these capacitors. A simple readout circuit is constructed to detect changes in the capacitance in the array based on the output signal, to provide the force information. Using a data acquisition system and National Instrument LabVIEW program, the signals are analyzed and magnitude and directions of the forces are displayed in real time.
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