Reference to paper (ICRA Paper #2315):
O'Neill, J.; Lu, J.; Dockter, R. & Kowalewski, T.
Practical, Stretchable Smart Skin Sensors for Contact-Aware Robots in Safe and Collaborative Interactions
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Abstract:
Safe, intuitive human-robot interaction requires that robots intelligently interface with their environments, ideally sensing and localizing physical contact across their link surfaces. We introduce a stretchable smart skin sensor that provides this function. Stretchability allows it to conform to arbitrary robotic link surfaces. It senses contact over nearly the entire surface, localizes contact position of a typical finger touch continuously over its entire surface (RMSE = 7.02mm for a 14.7cm x 14.7cm area), and provides an estimate of the contact force. Our approach exclusively employs stretchable, flexible materials resulting in skin strains of up to 150%. We exploit novel carbon nanotube elastomers to create a two-dimensional potentiometer surface. Finite element simulations validate a simplified polynomial surface model to enable real-time processing on a basic microcontroller with no supporting electronics. Using only five electrodes, the skin can be scaled up to arbitrary sizes without needing additional electrodes. We designed, implemented, calibrated, and tested a prototype smart skin as a tactile sensor on a custom medical robot for sensing unexpected physical interactions. We experimentally demonstrate its utility in collaborative robotic applications by showing its potential to enable safer, more intuitive human-robot interaction.