Electromagnetically Sensitive Soft Flexible Tactile Sensor

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Abstract—Advantages of flexible polymer materials with developments in refined actuation and sensing can be intertwined for a promising platform to work on a resilient, adaptable manipulator aimed at a range of biomedical applications. Moreover, soft magnetic material has an inherent property of high remanence like the permanent magnets [1-3] that can be further refined to meet ever-increasing demands in untethered and safe regulated medical environments. Although safe and favorable technology, due to the nonlinear relationship between electromagnetic torque and bending angle of the soft material, quantization of the magnetic field inside a deformable structure is still a nontrivial problem to investigate [4]. In this realm, we propose a novel soft-squishy, flexible force sensor approach for active tactile sensation that utilizes soft morphological computation. This research is motivated by hominoid finger's extraordinary combination of fibroblast bone tissue and flexible muscle for grabbing and sensing effective force feedback while gripping a delicate, fragile object in real-time environment. We intend to create an electromagnetically driven tactile sensing system that will be an integration of actuation (magneto rheological paradigm and electromagnetic) and sensing elements (electrical conductivity). The main idea of this proposal will be to have a comparative study with electrical conductivity to address the value of stress generated by the human finger with close proximity. This device when actuated will change its morphology/stiffness and generate electrical stimulus transitions for different posture of embedded sensing. As a result, the proposed device can be proactive in sensing tasks depending upon the EM field variations. Conclusively, this work will be an example of soft morphological control in sensing, and projected to open a new trend in development of tactile sensing system for medical rehabilitation device and therein.

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