

Technological marvels of soft actuators and robots

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Abstract: Soft robots/actuators are made of a highly deformable material(s) that permits multi-modal locomotion, manipulation, dexterity, and interactive interfacing than their rigid counterparts. Soft actuators are easily triggered by external stimuli and adeptly regulate the machine maneuvers with the opportunity to design compact, light-weight and compliant soft-robots. Actuation of soft robots / robot parts is implemented by exploiting multi-responsive hydrogels, pneumatic actuation, thermal, optical or magnetic stimuli, etc. Combining different techniques with varied actuating principles have helped to develop soft actuators where the basic actuation domain is material manipulation at micro-level, and the concept eliminates the maneuverability concerns of robots. Reversible configuration, mechanical compliance, easy interface interaction and digitalization, controllable-stiffness / stretchability, unprecedented adaptation, sensitivity and agility, least power consumption, etc., are some of the case arguments stroking the ingenious features of soft actuation with the non-skeletal framework. Non-rigid architectures based on microfluidic and soft lithographic techniques have proceeded to successful design and development of effective untethered, wearable, and autonomous soft machines.

Driven by both fast-growing market-needs and widespread scientific interests, research on soft robots has intensified over the past decade. Soft robotic devices for surgery and drug delivery, rehabilitation and assistance, prostheses and artificial organs, body-part simulators, etc. are some of the extraordinary biomedical applications where soft devices seem to open new possibilities. Developing fully autonomous soft robots from materials mimicked from nature that can adapt to the surrounding environment with compliant sensing and response is emerging as a captivating research field. So far, typical tubular soft robots included cable systems and inflatable structures driven by a pressurized fluid (gas or liquid). However, recently, robots entirely made of soft material(s) have been reported. In this talk, we would briefly like to present the futuristic prospects of soft actuation/ robots, along with a quick account on work from our group.

References:

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