

Advances in Soft Robotics: Emerging Paradigms for Bodyware and Control

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Abstract:

Over the past five decades, robotics has achieved remarkable progress, grounded in the foundational assumption that robotic systems are composed of interconnected rigid links. However, the emerging integration of soft materials—motivated by new scientific paradigms such as biomimetics and morphological computation, as well as a growing range of applications including biomedical devices, service robots, and search-and-rescue technologies—is challenging this traditional framework. As a result, many established theories and methodologies have become inadequate, paving the way for innovative approaches to robot design and control.

Current developments in soft robotics encompass diverse strategies for actuation and control. Although these advancements are still in the early stages, they hold significant potential to drive transformative technological change. Soft robotics represents more than an incremental development; it embodies a fundamental rethinking of robotics, reshaping long-standing principles and enabling the creation of a new generation of robots capable of interacting seamlessly with humans and operating effectively within natural environments.

Keywords:

Soft robotics, morphological computation, biomimetic robotics, biorobotics, smart materials.