

A Pneumatic Artificial Muscle with Tunable Force-Displacement Relation

Feedback-controlled, geometry-adjustable actuator that mimics muscle force for robotics and industry.

Researchers at Purdue University have developed a fluid-driven, tunable artificial muscle, akin to a variable transmission for soft actuators. The artificial muscle may be used in robots to better-control their movement, expanding their fields of use. The muscle may also find applications in pneumatically powered industrial equipment. Previously developed pneumatic artificial muscles (PAMs) allow limited control over the force-displacement relation. These PAMs may only be able to transition between "compliant" and "stiff" states. By varying its geometry, the Purdue-developed PAM is less movement-limited. This PAM can be tuned to exert a continuum of forces and move a continuum of displacements, allowing for fine-tuning via a feedback-enabled adjustable air chamber geometry.

Technology Validation: By varying the width of the pneumatic muscle and the length of the folded portion, the researchers created a design space of the force-strain relation of their PAM. The researchers have also demonstrated feedback control of the PAM length under loading using geometry change.

Advantages

- Highly-tunable
- Amenable to different materials of construction
- Feedback-controlled
- Compliant materials for safe power transfer

Applications

- Artificial muscle for robots and pneumatically-powered industrial equipment

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Category

Robotics &
Automation/Perception &
Sensing
Robotics &
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- Soft robotics

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