Fluidic Camming for Grasping

Tech ID: 34274 / UC Case 2025-349-0

BACKGROUND

Soft robotic grippers offer certain advantages for grasping objects and anchoring into environments compared to traditional rigid grippers. For instance, their conformability enables handling of delicate objects with simplified sensing and control, and their compliance allows them to be robust to impacts. However, soft grippers face two significant challenges: an inability to apply large grasping forces and the use of large and cumbersome pumps and power supplies, particularly for pneumatic systems. “Fluidic camming,” in which the force pulling on a gripper device pressurizes its actuating fluid, which, in turn, applies pressure to the grasped surface, offers a solution to these challenges. This technology is especially interesting for anchoring robots or humans to negative spaces in environments, such as cavities on a rock face, or as a gripper for gently manipulating a wide variety of both heavy and fragile objects.

DESCRIPTION

Researchers at the University of California, Santa Barbara have drawn inspiration from the ‘camming’ mechanism of traditional rock climber anchors to develop ‘fluidic camming,’ an analogous system but for a pressurized system. This innovative mechanism uses the pulling force of the device to generate system pressure to grasp an object or cavity using soft pressurized bags. The system can be hydraulic to reduce system size and enable theoretical grasping of arbitrarily large forces, or pneumatic to save weight. The devices are lightweight, work across a large range of cavity shapes and sizes, perform both negative and positive-space grasping, and do not require pumps, batteries, or disposable canisters to generate system pressure. They offer significant improvements to existing rock-climbing anchor devices. A device with mass 55 g anchored 667 N to a parallel-walled cavity; another device with mass 1.5 kg successfully lifted both a chicken egg and a 378 N weight.

Compared to existing pouch anchor systems for negative space anchoring, the device uses the weight of the fall to generate system pressure and expand the conformable grasping pouch into the cavity, rather than consumables CO_2 cartridges, adding the additional benefit of unlimited reusability. This technology can also be used for positive-feature grasping. In this application, the weight of the object loads the system to generate its pressure, which is used to squeeze soft gripper bags to interact with the object. This technology is particularly suited to securing robots by providing them with fixed anchor points or acting as a gripper to move objects or climb across surfaces with negative features. It offers both the benefits of a traditional cam, such as easy removal, reusability, and the fact that does not

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OTHER INFORMATION

KEYWORDS

fluidic camming, robotics, robotic gripper, anchor system, pouch anchor system, grasping devices, rock climbing, rock climbing anchors

CATEGORIZED AS

- **Engineering**
  - Other
  - Robotics and Automation

RELATED CASES

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slip and the benefits of a pouch anchor, including flexibility of use with a wide range of cavity sizes and ease of placement.

ADVANTAGES

- Reusable
- Easy to deploy and to remove
- Does not rely on consumables
- The non-slip design can accommodate a variety of applications and weights.
- Conforms to a wide range of cavity shapes & sizes

APPLICATIONS

- Robotics
- Rock climbing anchors
- Grasping devices

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Soft Burrowing Robot for Simple & Non-Invasive Subterranean Locomotion
- Self-Anchoring Burrowing Device for Sensor Placement with Low Reaction Force

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