TECHNOLOGY

Compliant Passive Grasping Technology for Arbitrary Shaped and Sized Objects

OVERVIEW

Background

Suction grippers (also referred to as "vacuum grippers") can grasp objects for handling and manipulation. They enable active control of grasp, enhance grasp stability, and handle some objects such as large flat plates more easily than standard graspers. However, the application of suction cups to object manipulation has been confined to a relatively small, well-defined problem set. Their potential for grasping a large range of unknown objects remains relatively unexplored. This seems in part due to the complexity involved with the design and fabrication of various materials comprising the grasper as well as actuators used to enable grasping.

A wide variety of robotic and automated tasks uses suction technology. For example, wall-climbing robots use suction to grasp walls. Applications for wall climbing include surveillance, cleaning, and inspection of confined spaces such as those of an aircraft. Suction grippers are used for grasping and manipulation of workpieces in industrial settings. Typical commercially available grippers are specific to particular types of workpiece and designed for narrowly defined object size and geometry. For example, they are designed to grasp flat, featureless panels, while others are designed for moving limp sheets, harvesting fruit, and/or holding documents. The ability to utilize suction grippers on a single grasper for manipulating objects with widely varying shapes and sizes will expand a robot's workpiece manipulation capability.

Innovative Technology

Researchers at the University of Maryland have designed, analyzed, and developed a fabrication method of a "self-selecting" suction cup assembly, which is an array of suction cups on a common flexible substrate. Such “self-selecting” suction cups comprising the grasper exert a suction force based on the object and suction cup(s) contact interaction forces, i.e., only those suction cups in contact with the object will engage with the object and produce a grasping force, when the object and suction cup interaction force exceeds an interaction force threshold value. Since the grasping is achieved purely by passive means, the cost and weight associated with individual sensors, valves, and/or actuators is essentially eliminated. Furthermore, the design permits the use of a central vacuum pump, thereby maximizing the suction force on an object and enabling some suction on surfaces that may prohibit tight seals.

Advantages
- Passive “self-selecting” actuation
- Suction force maximization
- Light weight
- Lower complexity
- Lower cost
- Suction cups printed on a flexible substrate for conforming to arbitrary shaped objects

Applications
- Healthcare

E.g., Stroke patient exoskeleton glove to train patient’s hand
- Agriculture
- Air delivery

- Packaging
- Military

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Additional Information

INSTITUTION

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CATEGORIES

- Robotics
- Industrial Processing
- Robotics
- Devices
- Engineering

EXTERNAL RESOURCES

- US Patent 8,382,174

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