

Researchers use air-filled modules to grasp, manipulate delicate objects

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Much like Baymax, the robot star of the animated feature "Big Hero 6," a soft robot skin developed by Disney Research uses air-filled cavities to cushion collisions and to provide the pressure feedback necessary for grasping delicate objects.

The researchers successfully used a pair of 3-D-printed soft skin modules to pick up a disposable plastic cup without breaking it, a roll of printer paper without crushing or creasing it and a piece of tofu without smashing it. Collision tests showed that the inflatable modules reduced the peak force of frontal impacts by 32-52 percent and side impacts by 26-37 percent.

"Humans interacting with robots in everyday environments is no longer just science fiction," said Joohyung Kim, associate research scientist. "Making them soft is particularly important for robots that will interact with children, the elderly, or with patients."

Kim and his Disney colleagues, Katsu Yamane and Alexander Alspach, will present their findings at the International Conference on Intelligent Robots and Systems (IROS 2015) on Sept. 28 in Hamburg, Germany.

The air-filled skin modules can absorb unexpected impacts. By monitoring pressure changes that occur when the airtight, but flexible chamber is deformed, it also can serve as a contact sensor, providing feedback for touching, grasping and manipulating.

The researchers built soft skin modules that were cylindrical with hemispheric ends, a little less than 5 inches long and about 2 ½ inches in diameter. In addition to the air-filled outer skin, each module included a rigid link at the center. The modules thus could employ a variety of material properties, from flexible to rigid.

In experiments using only the rigid link, with the outer, inflated skins removed, the researchers were able to use them to grasp a disposable cup. But without the pressure feedback provided by the soft skin, the cup ultimately was crushed. With the soft skins attached, the researchers obtained sufficient pressure feedback to grip the cup, and hold other delicate objects, without damaging them.

The same design concept used to produce the modules can be employed to make other modules of varying geometries, they noted.

Provided by Disney Research

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