A small bag filled with coffee grounds is lending robots a fingerless hand. The new kind of gripper, described online the week of October 25 in the *Proceedings of the National Academy of Sciences*, is capable of grasping all sorts of different objects with ease.

“This could be game-changing technology,” says mechanical engineer Peko Hosoi of MIT, who was not involved with the new study. “The idea is so simple, yet effective and robust.”

The simple gripper is made of a bag of coffee grounds and a vacuum, though other grains such as couscous and sand also work, says study coauthor Eric Brown of the University of Chicago. To pick something up, the bag of loose grounds first melds around the object. Then, as a vacuum sucks air out of the spaces between grains, the gripper stiffens, packing itself into a hard vice molded to the outline of the object. Reducing the bag’s starting volume by just a teeny amount — less than 1 percent of the total — was enough to make the gripper latch on, the team found.

This transition from fluidlike behavior (such as dry sand flowing out of a bucket) to solid (a hard-packed sand castle) is a physical process called “jamming.” Because the gripper’s bulb conforms to any shape evenly before the vacuum jams it, it’s extremely versatile. “Our goal was to pick up objects where you don’t know what you’re dealing with ahead of time,” Brown says.

Gripper designs based on rigid metal fingers — like the classic arcade game with a claw that picks up toys — range from two-finger pincers to humanlike hands with five fingers and multiple joints. But all of these designs have to contend with complex finger positioning and forces. “This approach is totally different,” says mechanical engineer Mark Yim of the University of Pennsylvania in Philadelphia. “It approaches grasping from a very different angle.”

In experiments, the gripper started by picking up little things the researchers found lying around the lab: a pen, plastic tubing, a coffee mug, a shock absorber, a jack. The gripper held a cup of water well enough to pour, and a pen well enough to write. In a more daring feat, the gripper lifted a pair of water-filled gallon jugs tied together with a rope by wrapping itself around the handle of one and hoisting. And in one of the ultimate tests for robotic hands the gripper picked up a raw egg, a formidable task because hard metal pincers or fingers can concentrate force in a few small places, shattering the fragile shell.

“One of the tricky things about picking up delicate objects is that you have to know how much pressure to apply: too little and you drop the object; too much and you break it,” Hosoi says. “This new gripper works by exactly
conforming to the shape of the object so you can manipulate items with very little pressure — and without requiring feedback from sensors.”

One kink in the design is that the gripper must apply pressure against an object in order to mold properly. If the gripper were to come at a mug handle from the side, it wouldn’t be able to get a grip. Instead, it would scoot the mug along the table and over the edge. Brown says the design could be combined with a more traditional finger-based scaffold to provide more control.

Brown and his colleagues calculated that a similar gripper with a diameter of a meter would be powerful enough to lift an object weighing one metric ton. A scaled-up version might be helpful in search-and-rescue missions, Brown says. “You’re posed with a problem of rubble of all sizes and shapes,” so having a flexible gripper would be desirable.

*Video: A robotic gripper made of a stretchy bag of coffee grounds and a vacuum picks up a shock absorber with ease. Vimeo.com/John Amend*

See Also:

- Video: Robotic Hand Uses Shark-like “Sixth Sense” to Find Its Grip
- Gallery: Robotic Sub Installs Deep-Sea Webcam
- Robot Arm Gives Stroke Patients a Hand
- Why NASA Is Sending a Robot to Space That Looks Like You
- Honda’s Robolegs Help People Walk

Tags: Robotics, robots

Also on Wired.com

- Apple Bans Lame WikiLeaks App
- Acidifying Oceans Could Upset Life’s Nitrogen Cycles
- Video: Navy’s Electromagnetic Plane Launch
- FCC Passes Compromise Net Neutrality Rules
- Reader Photos: Lunar Eclipse Solstice Special
- Killer Drones Converge on California, Ready to Take Off

Related Topics:

- Mark Yim
- NASA
- Philadelphia
- University of Chicago
- Vimeo.com