Docket #: S14-435

Micro-robots capable of towing 2000x its weight using dry adhesive

Stanford researchers at the Cutkosky Lab have patented a method of towing or pushing an object using a micro-robot. This micro-robot can drag loads almost 2000x its weight by using controllable dry adhesive for robotic "feet" that can develop huge amounts of shear force. These adhesives prevent slipping by dramatically improving the ground reaction force (1000x). Then this force can be easily deactivated so the robot maintains its gait. This technology could enable whole new capabilities in robotics which were previously not feasible due to insufficient force. For example, 1 kg autonomous robot could theoretically move a pallet of goods.

A 12 gram "micro tug" robot moves objects 2000 times its size on glass (steel objects without wheels or lubrication) enabled by dry adhesives. This capability is comparable to a human dragging a blue whale. Even if the human was strong enough, their shoes would just slip making this impossible without this micro robot's special gecko-inspired dry adhesive "shoes."

Stage of Research
The inventors have implemented this technology in a 12g “micro tug” robot that uses controllable adhesion to tow over 20kg.

Applications

- **Robotics** - with end user applications such as:
  - industrial robotics (e.g., moving pallets)
  - aerospace robotics (to move objects when gravity is not available)
  - mobile assist devices
  - toys

Advantages

- **Increased force** - robot can generate over 1000x more force with minimal impact on energy or walking gait
- **Controllable adhesive** - can be activated for towing and deactivated for locomotion with low energy expenditure

Publications

- Patent **US10011010** "Dry Adhesives for Enhancing Ground Reaction Forces Substantially Beyond Friction". Issued 7/3/18
- Christensen, D. L., Hawkes, E. W., Suresh, S. A., Ladenheim, K., & Cutkosky, M. R. µTugs: Enabling Microrobots to Deliver Macro Forces with Controllable Adhesives.

Patents

- Published Application: 20160199976
- Issued: 10,011,010 (USA)

Innovators

- Elliot Hawkes
- Mark Cutkosky
- David Christensen
- Arul Suresh

Licensing Contact

Matthew Ryan

Licensing Manager

Email