

# Researchers develop reprogrammable bistable soft gripper for enhanced human-machine interaction

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Soft grippers have advantages in human-machine interactions, but most of them suffer from low response time. Bistable structures could

improve this characteristic, but the performance of current bistable grippers is limited by their predefined structural parameters and grasping modes.

A research team led by Dr. Li Yingtian from the Shenzhen Institute of Advanced Technology (SIAT) of the Chinese Academy of Sciences (CAS), has proposed a novel type of soft gripper based on reprogrammable bistable [actuator](#), which allows [precise control](#) over diverse sensitivities and offers multiple gripping modes and adjustable response speeds through straightforward reprogramming. [The study](#) was published in *IEEE/ASME Transactions on Mechatronics*.

The reported soft gripper consisted of a bistable frame and soft pneumatic bi-directional actuator, linked by an unstretchable cable. In the programming process, the pneumatic actuator shortened its longitudinal length to pull the frame through the cable, resulting in the gradual accumulation of the strain energies of the lateral plates, and reducing the energy required for the fast snap-through of the structure. The structure showcased its reprogrammable nature by adapting to various intermediary states with different sensitivities.

Additionally, the researchers analyzed the force-displacement relationship of the frame and the predicted trigger forces. The results showed that the force required to trigger the fast snap-through could be less than 0.005 times of its maximum value, simply by reprogramming the structure's sensitivity.

To demonstrate the uniqueness of the proposed actuator, the researchers prototyped multiple grippers to conduct multimodal and fast grasping tests. The [gripper](#) could even be able to respond to contact of a swimming fish and capture it within 0.18 s.

"Our team has been investigating the ultra-tunable bistable structure for

a few years and the achievements have been published in many international journals," said Dr. Li. "The ongoing studies are investigating other applications in the fields of robotics and bioengineering."

**More information:** Yongkang Jiang et al, Reprogrammable Bistable Actuators for Multimodal, Fast, and Ultrasensitive Grasping, *IEEE/ASME Transactions on Mechatronics* (2023). [DOI: 10.1109/TMECH.2023.3318976](https://doi.org/10.1109/TMECH.2023.3318976)

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