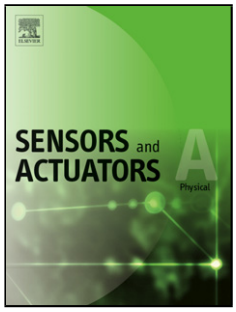

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Design and position/force control of an S-shaped MFC microgripper

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Highlights

- A new macro-fiber-composite microgripper with a large displacement-volume ratio is proposed.
- Nonlinear dynamic model based on Hamilton's principle and Bouc–Wen hysteresis equation is established.
- A smooth position and force switching control scheme is designed.
- Several experiments and validations are carried out and the experimental results validate performance of the microgripper and effectiveness of the developed control scheme.

ABSTRACT
Micromanipulation tasks require microgrippers equipped with large displacement/size performance and position/force control capabilities. This paper reports the structural design, implementation and position/force switching control of an S-shaped microgripper which is driven by the micro-fiber-composite (MFC) actuator. Unlike conventional piezoelectric microgrippers, the MFC one can provide excellent characteristics of a larger displacement-volume ratio (i.e. the ratio of the maximal output displacement to the total volume of the microgripper) and simple structure. Combining the Hamilton's principle and the Bouc-Wen model, the dynamic model considering both the structural flexibility and the hysteresis nonlinearity of the microgripper is derived.