

Supplementary Information

Low-Profile Folding Mechanism for Multi-DoF Feedback Control

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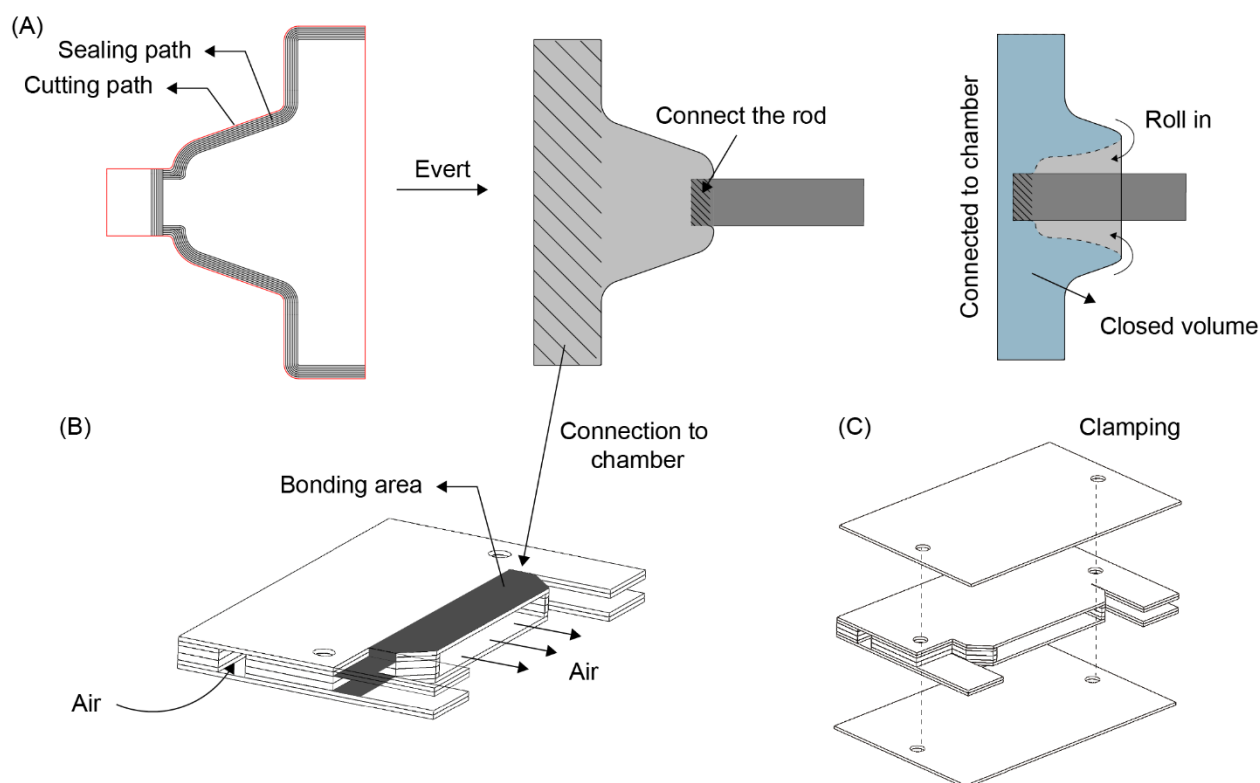


Fig. S 1 Fabrication details for the rolling diaphragm and its integration with the pneumatic chamber and actuation rod. (A) Laser cutting and sealing process: the red line indicates the cutting path, while the black lines represent the sealing paths, followed by a defocused low-power laser that melts the bonding material. After cutting and sealing, the diaphragm is everted and attached to both the actuator rod and chamber, forming a closed volume throughout actuation due to its eversion-based motion. (B) The chamber structure showing the connection point of the diaphragm. (C) The clamping of chamber integrated with diaphragm from top and bottom for better sealing.

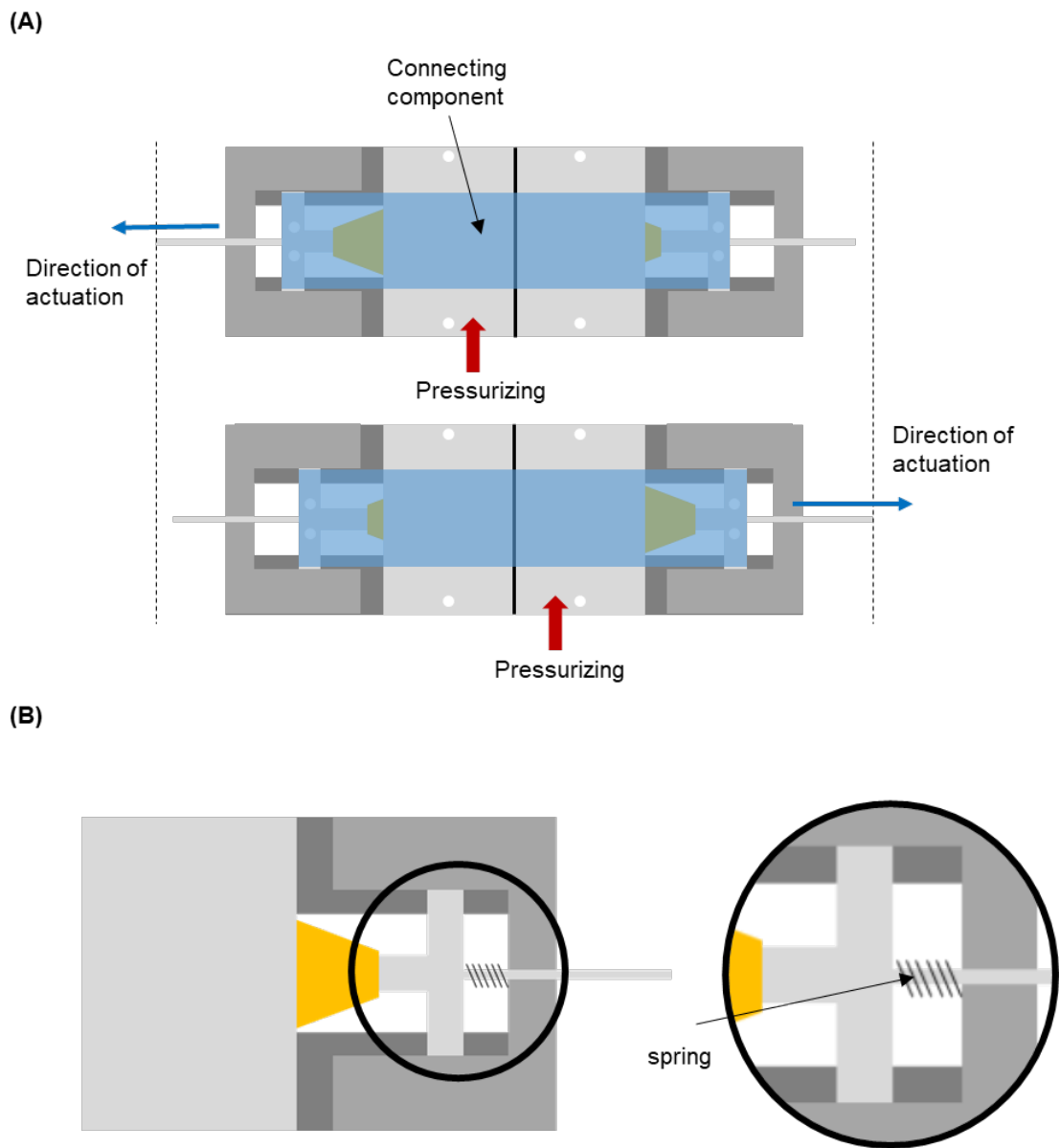


Fig. S 2 Methods for enabling restoring capability in the actuator. (A) Antagonistic actuation by connecting two actuators in opposing directions. (B) Incorporation of a spring that compresses during actuation to provide a restoring force.

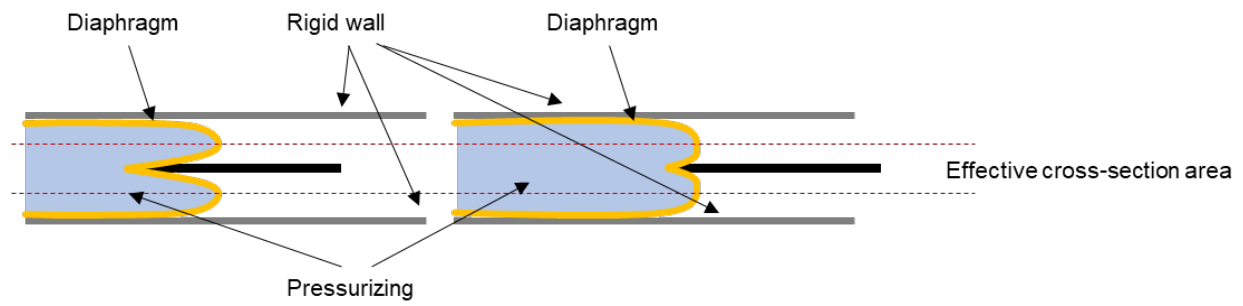


Fig. S 3 Side view of rolling diaphragm and effective cross-section area while everting. The effective cross-section area remains the same.

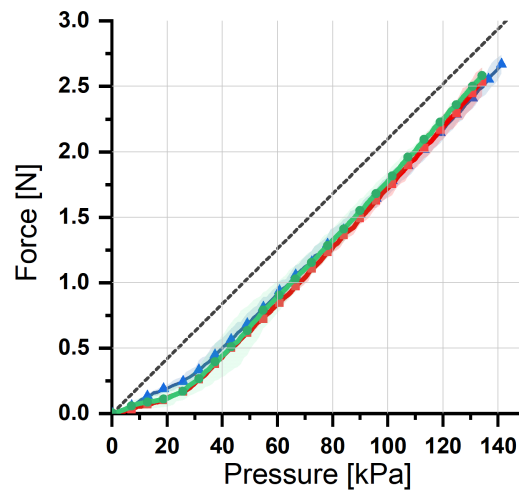


Fig. S 4 The blocked force experiment results at the bottom dead center for three different samples, presented separately to highlight the variance between them.

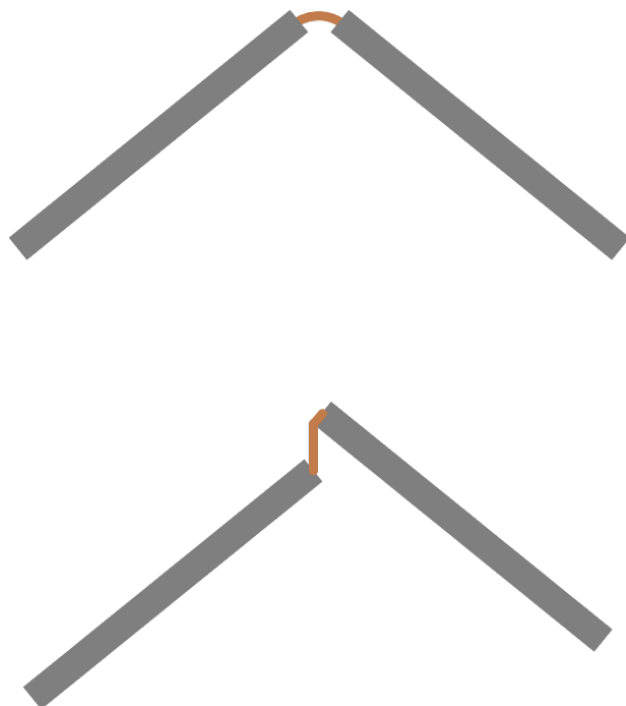


Fig. S 5 The bucking of origami joint.

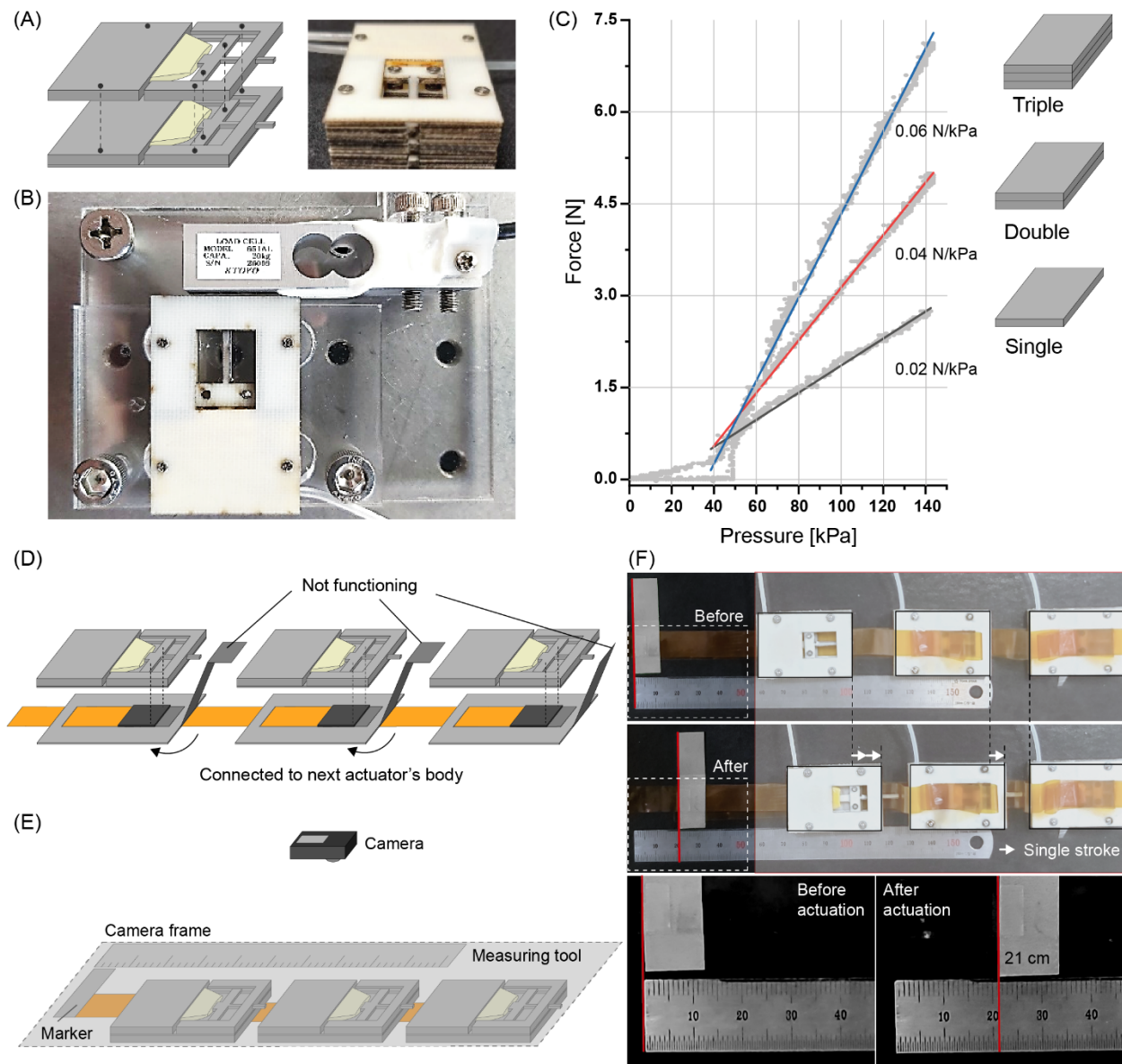


Fig. S 6 (A) Multiple actuators connected in parallel to increase output force. (B) Experimental setup used for measuring force output. (C) Measured force output for different numbers of actuators connected in parallel. (D) Illustration of a serial connection. (E) Experimental setup for evaluating stroke extension in series configuration. (F) Resulting stroke length increase achieved through series connection.