

Electroactive origami actuator

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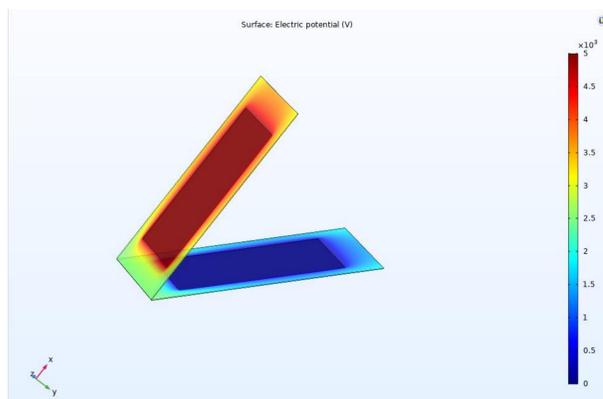
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Introduction

As one traditional technology, origami has attracted substantial attention of scientists. This ancient technology possessing intriguing advantages has been explored in a wide variety of applications, such foldable battery, medicine deliver, especially in actuator field. The electrostatic force can be easily applied for triggering origami actuator owing to the coupled foldable facets of origami. This study investigated the influence of material properties on the actuation performance of origami actuators by combining experimental results and the computational simulation. The knowledge gained here will serve as fundamentals of future designing and developing novel origami actuators.

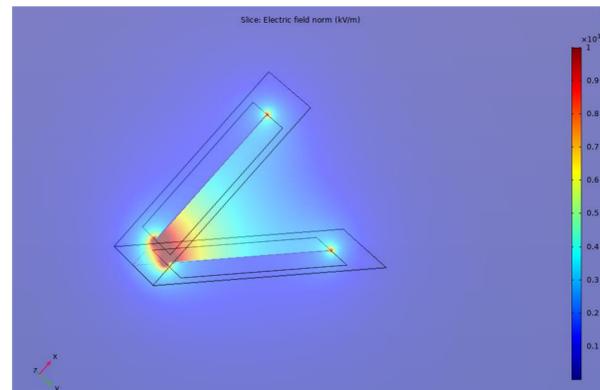
Simulation

The zig-zag unit was studied as basic unit model. The simulation was done by COMSOL.



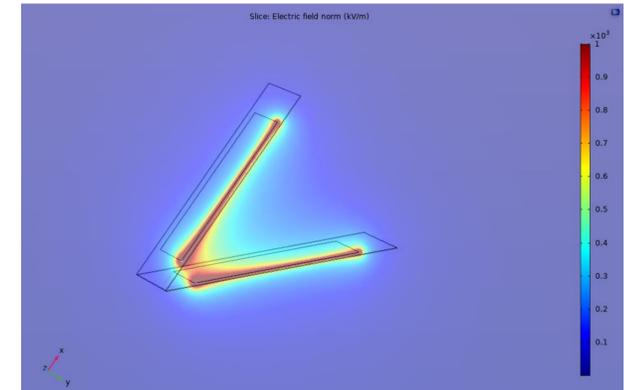
Surface Electric Potential

- Material
 - Electrodes: copper
 - Substrate: paper
- Two electrodes connect to ground and positive electricity, respectively.
 - The red color is representative for greatest electric potential.
 - The blue color means 0.



Electric Field of Middle Cross-section

- The slice was set at the middle of the electrodes which represents the main electric field distribution.
- The red color means highest electric field area.
- The edge of the electrodes have significant affect on electric field.
- The magnitude of the electric field decrease rapidly with the distance between two electrodes increasing that is follow the Coulomb's law.



Electric Field of Edge

- The distribution of electric field is significantly different at the electrode's edges which is stronger than the middle.

Conclusion & Outlook

This is a fundamental study for exploring origami actuator. Due to the zig-zag unit is the basic unit for most of origami pattern, it is valid to explore the property of zig-zag unit. This design can be applied to complicate origami structure to achieve complicated motivation. For instance, the extension and contraction motions can be generated by Mura-ori. The bistable structure waterbomb can be used as the signal. Based on this study, more possibility and application of origami actuator is enabled to explore.