

11. Development of Soft Gripper Based on Bistable Dome Shell Effect

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Introduction. This study aimed to investigate the principle of implementation of the bistable shell dome effect in a traditional soft gripper based on FEA technology and estimate approximate parameters and geometry for greater performance.

Materials and Methods. Inventor Software package and Ansys engineering simulation were used to simulate kinematics and numerically investigate behavior for the suggested design and evaluate the success of imparting property of maintaining the form of activated state in case of increased grip strength due to domelike structures resilience.

Results and Discussion. Based on the results of a review and analysis of scientific works and existing patents a new principle was proposed to integrate into a classic FEA gripper. The new design of these dome-like structures is integrated into bellows-like structure soft walls. Mechanical instabilities of such structures are harnessed to attain new properties and functionalities are used to implement the next advantages: the ability to hold its shape in case of pressure loss, significantly faster response, holding force increasing due to domes resiliency. Physical tests show that the difference in pressure for the transferring between stable states for dome differs more than 10 times, 105kPa to evert it from the initial state, and 9kPa for returning to the original state. In general, simulation results correspond to physical tests.



Fig.1 a) Pressure test; b) numerical modeling

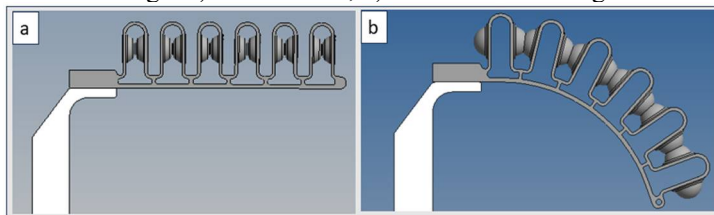


Fig.2 a) Initial state, domes are everted; b) activated state after inflation.

Conclusion. The results of the study revealed that the demonstrated principle can be implemented and has great potential, but this work requires further research and full-size prototyping.

References

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