

2. Describe the hinge mechanism presented in the paper. Discuss the techniques used to control the bending direction and angle of the hinge. What compound transformations are possible through the combination of hinge mechanisms?

The hinge mechanism is a pneumatic mechanism that allows one to directly encode user-defined material's shape-changes within 2-Dimensional structures. This technique is very flexible and allows for a large variety of inflatable material behaviors while minimizing the complexity of the design and fabrication process. The design in the paper consists of a software simulation platform that predicts the shape-change and outputs vector paths for digital fabrication, multiple fabrication methods, including manual heat sealing, heat pressing with custom stencils and a heat-sealing head for 3-axis CNC machines, and a tested material library with fabrication parameters that performs reliably with this method. Their method encodes shape-changing by simply varying the shape of heat-sealed hinges, bypassing the complicated molding and casting process previously proposed for creating complex pneumatic shape-change. Hinges have a general direction or angle for bending and there are techniques that go hand-in-hand with these vectors. For example, in order to change the angle of a hinge mechanism, you must modify the dimensions so the relationship between the corners are varied. In the paper, they focus on airbags and hinges that are fabricated via heat sealing, either manually, robotically or with a heat press. Each of those techniques utilizes heat and mechanical compression to seal two pieces of sheet material, and each sealing process creates a gentle "folding crease", which slightly bends the fabric piece in the direction of the heating element. The bending direction of a hinge mechanism can be controlled by determining from which side the material is sealed. As a heat-sealed hinge is inflated, the bending force occurs and the folding crease determines to which side the material bends. These techniques allow easy manipulation of designs which is very similar to the modification in origami. By using hinge mechanisms, you are also able to create a variety of compound transformations. Some kinds of compound transformations include stripe curling and twisting, square surface curving, square texture changing, polygonal self-folding, and polygon-popping. As a result, hinge mechanisms are very useful and manipulate for design and they come in so many forms so customization is easy and effective.