Title: Rapid Deployment of Curved Surfaces via Programmable Auxetics

Link: https://lgg.epfl.ch/publications/2018/ProgrammableAuxetics/paper.pdf

Contributions

The deployable range of an auxetic structure can be controlled by the size of unit cells as well as how "deployed" the unit cells are in the 2D configuration. This allows for control of the deployed curve surface because nonuniform forces will lead to buckling.

Actuation done via inflation or by gravity. These types of actuation allow for maximum deployment which ensures that the deployed structure matches the target shape as close as possible.

Inflation Actuation

Assumption of a thin membrane which is isotropic and has elastic properties. Structures that can be actuated using inflation are concave curved surfaces. As a balloon is inflated it pushes up against the material causing it deform.

Gravity Actuation

Auxetics can be actuated via gravity. This is effective for simple curved surfaces. This process involves constraining the boundary of the structure and letting gravity do the work.

mechanical properties

The flexibility of linkages enable the creation of a multitude of curved surfaces. Varying deployed cells causes out of plane buckling which leads to the formation of the curved surface.

Application

Customizable coronary stents relocatable structures

Limitations

Inflation and gravity actuation methods only work for limited amount of curved surfaces. The surfaces for which they work for positive mean curved surfaces. Does not address fabrication related issues. Does not address optimizing joints that are connecting the triangles for better deployment.

Future Directions

Using string as an actuation method. Testing methods to keep the structure in the deployed state permanently.

Citations

References

[1] Mina Konaković-Luković, Julian Panetta, Keenan Crane, and Mark Pauly. Rapid deployment of curved surfaces via programmable auxetics. *ACM Transactions on Graphics (TOG)*, 37(4):1–13, 2018.

Tag: curved [1]