



Topic Areas:	Design, Manufacturing, Characterization
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Pre-requisites/Prior Knowledge:	CAD Design, Matlab

Soft robots are characterized by compliance and adaptability, offering numerous advantages over traditional rigid robotics. These systems are inherently safer for interaction with humans and can operate in unstructured environments, making them ideal for applications in healthcare, wearable technology, and soft-grasping tasks. Unlike traditional robotics, soft robots can deform, adapt to complex environments, and perform tasks that require high flexibility or gentle manipulation. Beside advantages there is also some drawbacks of soft robots such as need of bulky and complex controls systems.

An interesting, but little studied, actuator geometry is cylindrical actuators, similar to the party balloons used to make balloon animals. They exhibit complex motion patterns, which may be used to embody control. This thesis aims to develop cylindrical balloons with prescribed pressure-volume and deformation characteristics. The research focuses on devising a fabrication method that leads to symmetrical balloons that extend upon pressurization. With this method, actuators with different geometrical parameters and silicones elastomer with different stiffness will be fabricated and compared to a simple numerical model.

Key objectives of this thesis include

1. Devising a fabrication method for symmetric actuators with pre-described geometry
2. Fabricating and characterizing prototypes of actuators
3. Comparison of the results with a numerical model
4. Design and characterization of actuators with varying geometry

This project combines design, fabrication, experimental validation, and simple numerical modeling. Depending on the type of thesis, the objectives will be adapted.

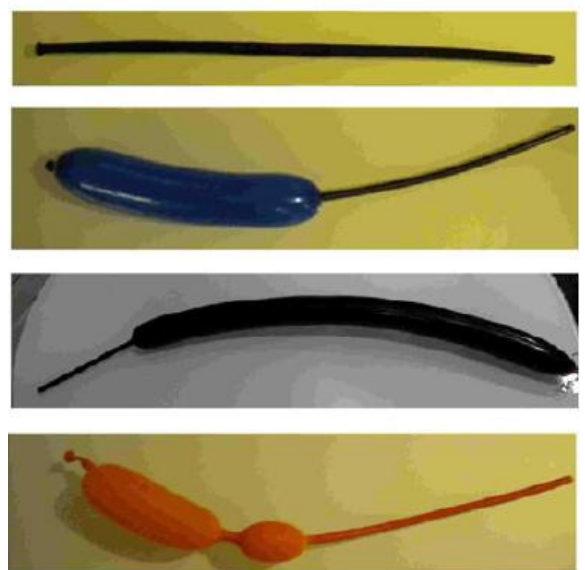


Figure 1: Cylindrical Balloon Actuator [1]

[1] Lu, TQ., Suo, ZG. Large conversion of energy in dielectric elastomers by electromechanical phase transition. Acta Mech Sin 28, 1106–1114 (2012). <https://doi.org/10.1007/s10409-012-0091-x>