عنوان مقاله:

Effects of Inflation Pressure and Wall Thickness on Gripping Force of Semi-Cylindrical Shaped Soft Actuator: Numerical Investigation

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خلاصه مقاله:

Soft robotics using Pneumatic Network actuators (Pneu-Net) is a developing field that has a promising future for variety of applications involving delicate operations such as biomedical assistance. The interaction between geometry and the performance of the actuator is an important topic which has been studied by many researchers in this field. However, there is a lack of investigation on the relationship between gripping capability and geometrical parameters of soft actuators. Especially, there is a need to shed more light on the effects of wall thicknesses on the gripping force developed. In the present study, a semi-cylindrical chambered PneuNet soft actuator is numerically investigated to evaluate the effects of pressure and wall thickness variations on its performance characteristics. The results revealed that increasing the restraining layer thickness (RLT) aids the bending capability of the actuator whereas increasing the chamber wall thickness reduces it. Therefore, maximum bending of the actuator is achieved at the combinations of minimum wall thickness and maximum RLT. At these geometrical configurations of maximum bending, the deformation-pressure relationships followed a sigmoidal function and tended towards linearity with increasing wall thickness and decreasing RLT. The gripping force showed an exponential increase with increasing working pressures and wall thicknesses. The maximum gripping force increased cubically with increasing wall thicknesses at their respective maximum working pressures, which was modeled using a polynomial regression model (R۲=۹۹.۷۹%).

کلمات کلیدی:

Soft actuator, Pneu-Net, Hyperelasticity, Inflation pressure, Gripping force