**Introduction**

In this paper, we focus on a simple form of a soft gripper, a four-fingered pneumatic actuated elastomeric robot that approximate the biological finger with infinite degrees of freedom. This robot only requires simple control for pneumatically actuation: deflating the soft actuators to open the gripper jaw to approach the objects, then inflate the soft actuators to contact with the surface of the objects to be gripped. Then we used a selectively-placed nylon tendon that acts to mechanically change the finger area of inflation and deflation (we term the length of this area as “effective length of the robotic finger”). We quantified the gripper’s displacement of deformation and pull force while gripping objects with different shape, size and material stiffness under a number of effective finger lengths and pneumatic air pressures. Based on the experimental results, we formulated several hypotheses of the gripping mechanisms.

**Results**

Based on the experimental results, we formulated several hypotheses of the gripping mechanisms. We quantified the gripper’s displacement of deformation and pull force while gripping objects with different shape, size and material stiffness under a number of effective finger lengths and pneumatic air pressures. Based on the experimental results, we formulated several hypotheses of the gripping mechanisms.

**Materials and methods**

**Conclusion**

Our results demonstrated how a pneumatic actuated elastomeric gripper associated with an inflation/deflation transition enables it to grip a wide range of different objects reliably. The kinematics of the current soft gripper showed a possible object size range up to 160 mm, which is similar to that of the human hand [3]. We tested the pull-off force of the gripper as function of object size, shape and material stiffness under a range of effective finger lengths. A maximum pull-force of 13.5N was observed according to all experimental trials in this study. With addition of tunable effective finger lengths, the soft gripper can easily grip objects larger than itself (Fig. 7(a)), a plastic bag filled with milk (Fig. 7 (i)) and a compact disc (Fig. 7((i)) and a plastic bag filled with milk (Fig. 7 (i)) etc. These items, to our knowledge are difficult to manipulate each by using some famous universal robotic gripper prototypes, such as the jamming gripper.

For the ongoing work, we are investigating the geometrical effect of the soft robots and material stiffness using both Finite Element Analysis (FEA) simulations and experiments. We are also quantitatively elevating the gripping speed and precision of pick-place of the soft gripper as well.

**Acknowledgement**

This work was supported by the National Science Foundation support projects, China under contract number 61404012, Beijing Science Foundation support projects under contract number 4154077 and National Science Foundation support projects, China under contract number 61333016. Authors are with the School of Mechanical Engineering and Automation, Beihang University, Beijing, 100191, People’s Republic of China; e-mail Prof. Li Wen for contact: liwen@buaa.edu.cn.