

Robot Gripper

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Introduction

Robot arms⁽¹⁾ are usually designed to handle a job for a human. They're usually motor operated, and are composed of parts connected together through joints in order to mimic a human hand's movements (although, some are much more primitive; i.e. not exhibiting the complex anatomy of a human hand).

A special class of robot arms are robot grippers, which are usually primitive in shape.

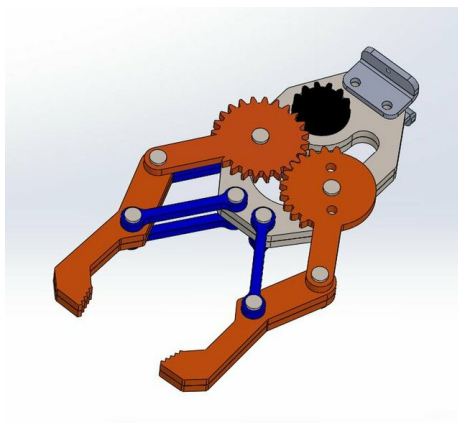


Figure 1: Example of a Gear-Operated Robot Gripper

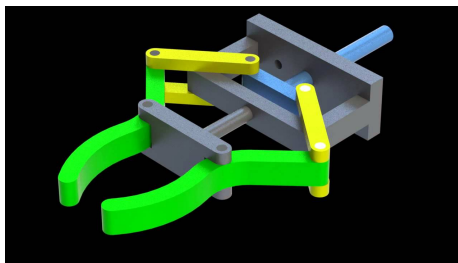


Figure 2: Example of a Piston-Operated Robot Gripper

Robot grippers are usually constructed using simple mechanisms, such as a gear-operated gripper, which mainly depends on a set of gears to work, or such as a piston-operated one, which relies on a piston to open and close the hand.

Robot grippers are most often used for a simple reason; that is⁽²⁾, a human hand is prone to tiring and is prone to making mistakes and errors during repetitive tasks, while a robot gripper does not tire and operates endlessly and tirelessly. For this reason, robot grippers are sometimes used in the industry in production lines, where routine tasks are to be performed continuously.

Design

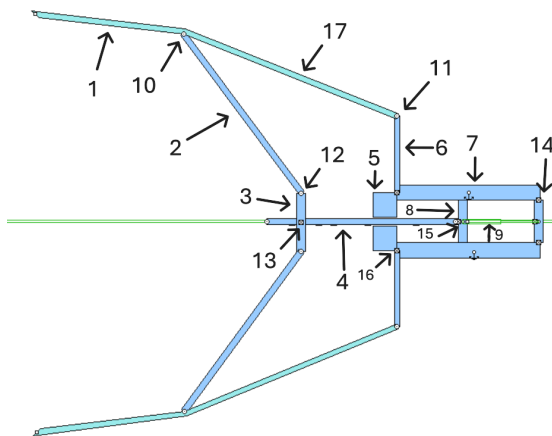


Figure 3: Robot Gripper Design

Note: All the members are made of steel to withstand any hard tasks.

Member 1 \rightarrow H = 0.02 m W = 0.5085 m

Member 17 \rightarrow H = 0.02 m W = 0.7521 m m_{1+17} = 2.26 kg

Member 2 \rightarrow H = 0.65 m W = 0.02 m m = 1.3 kg

Member 3 \rightarrow H = 0.19 m W = 0.03 m m = 0.57 kg

Member 4 \rightarrow H = 0.02 m W = 0.63 m m = 1.26 kg

Member 5 $\rightarrow L = 0.08 \text{ m}$ $m = 0.64 \text{ kg}$

Member 6 \rightarrow H = 0.25 m W = 0.016 m m = 0.4 kg

Member 7 \rightarrow H = 0.05 m W = 0.47 m m = 2.35 kg

Member 8 \rightarrow H = 0.14 m W = 0.03 m m = 0.42 kg

Member 9 \rightarrow Actuator

Member 10, 11, 12 \rightarrow Pin joints

Member 13, 14, 15, 16 → Connecting joints

Results

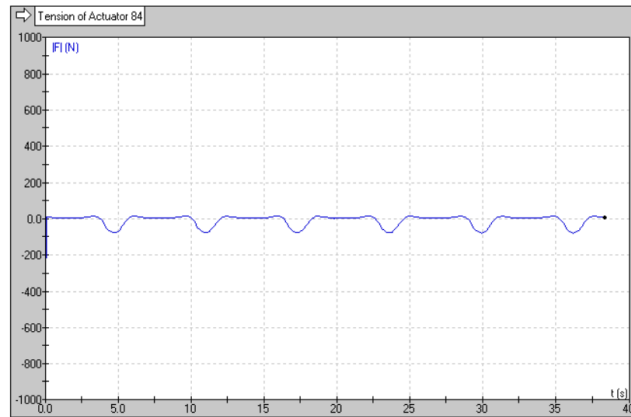


Figure 4: Actuator tension

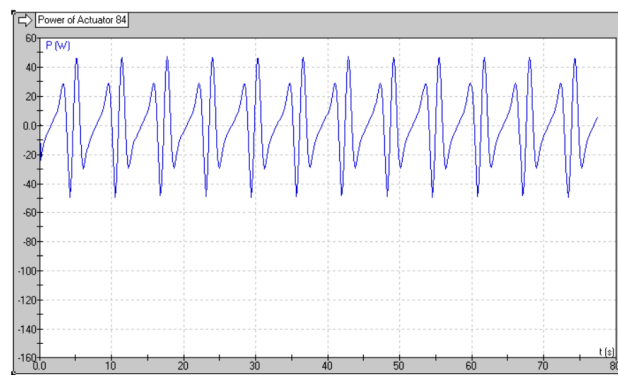


Figure 5: input power

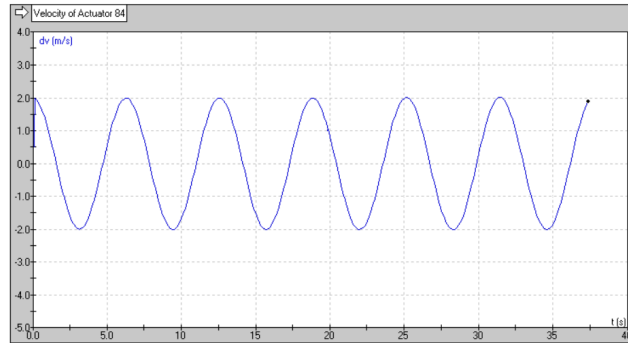


Figure 6: Actuator velocity

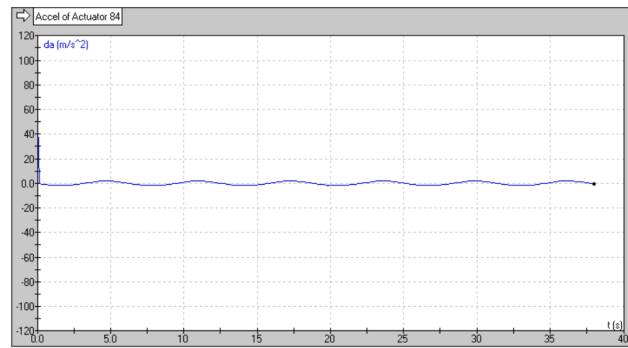


Figure 7: Actuator acceleration

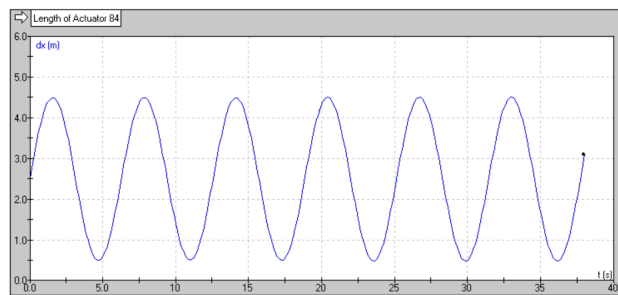


Figure 8: Actuator length

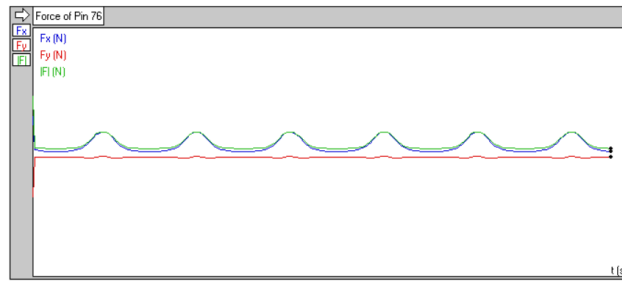


Figure 9: Member 10 force

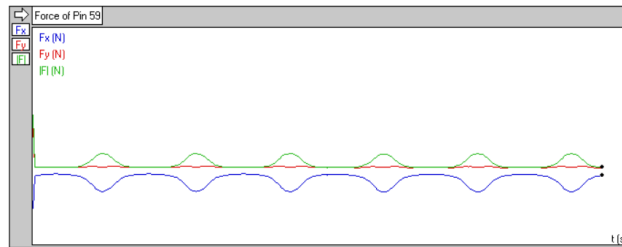


Figure 10: Member 12 force

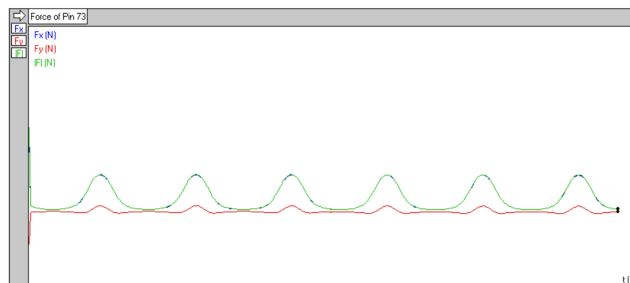


Figure 11: Member 11 force

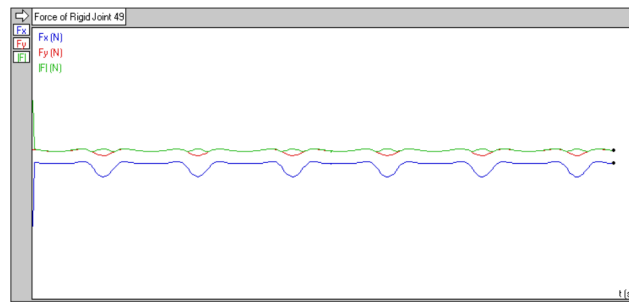


Figure 12: Member 13 force

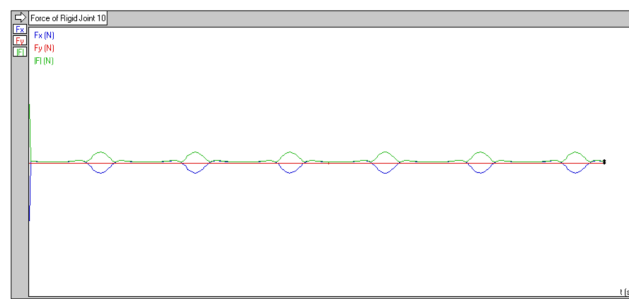


Figure 13: Member 15 force

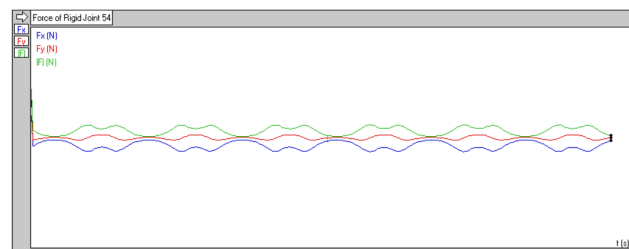


Figure 14: Member 16 force

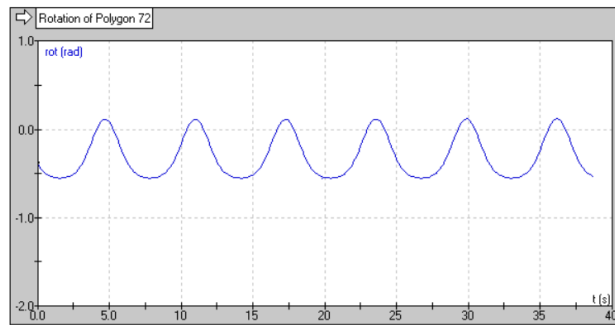


Figure 15: Member 1+17 P-V-A

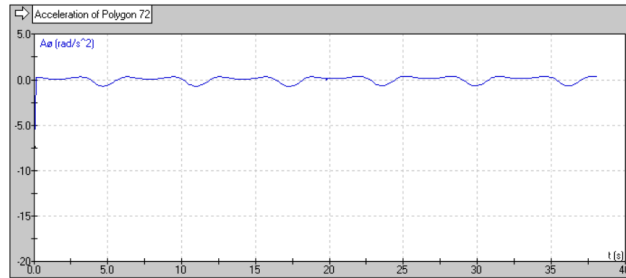


Figure 16: Member 1+17 acceleration

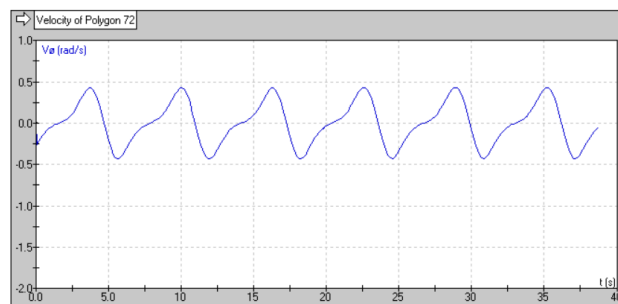


Figure 17: Member 1+17 velocity

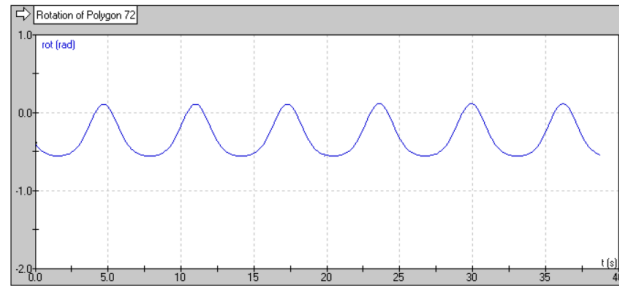


Figure 18: Member 1+17 position

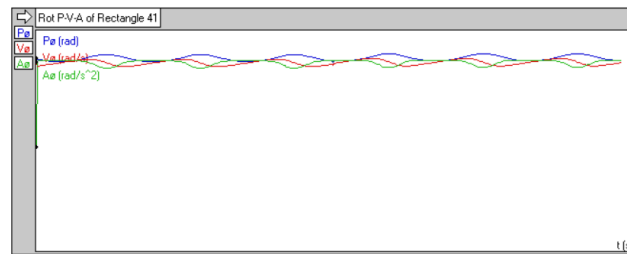


Figure 19: Member 2 P-V-A

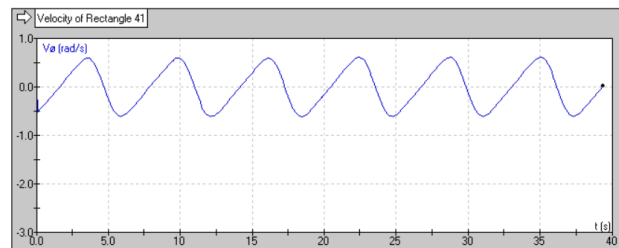


Figure 20: Member 2 velocity

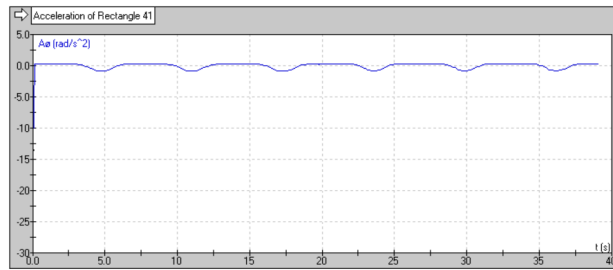


Figure 21: Member 2 acceleration

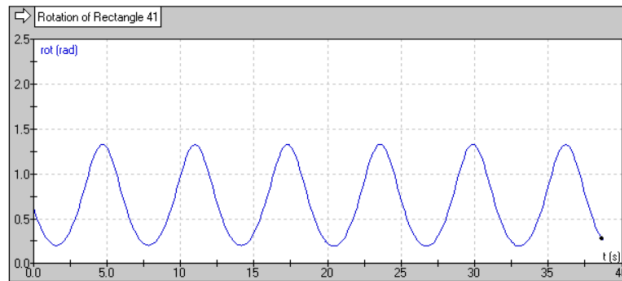


Figure 22: Member 2 position

Any graphs that were not considered on other members were due to the constant factors affecting them , So it wasn't necessary to include them in our graphs as they didn't contribute in any calculations.

Conclusion

In conclusion, robot grippers are mainly used for their ability to perform routine actions tirelessly, where a human would be more error-prone. For this reason, we've designed a robot gripper (albeit small-scale), which performs said menial tasks without any issues. With this report, we have included the necessary dimensions needed for the design, as well as the masses required to construct such a system, alongside some images of the finished design.

References

⁽¹⁾ Universal Robots. "ROBOTIC ARM" ⁽²⁾ Universal Robots. "Robot Grippers Explained"