We present the design and fabrication of a configurable anthropomorphic underactuated hand for multipurpose manipulation tasks. In order to increase the versatility of an underactuated hand, a mechanical selector was introduced to individually control the actuation for each of the four tendon-driven fingers. The selector is controlled by a servo motor and the grasping motion is controlled by a DC motor. The body of the hand and fingers are 3D-printed from a rigid plastic while the antagonistic passive elastic members for the fingers are a silicone elastomer. Lastly, the hand uses a differential pulley system for an adaptive grasp.

The mechanical selector is the key component which controls the actuation of each finger. If the gate is closed, then the finger tendon is physically blocked and thus the finger cannot actuate. Each gate is opened and closed by a servo motor, where a clockwise motion opens the gates and a counter-clockwise closes the gates. It is possible to choose which gates are opened and closed by either bypassing the gate by continuously rotating clockwise until it reaches the next gate or rotating counter-clockwise to close the gate and to continue to the next gate.

Conclusion and Future Work

The configurable anthropomorphic underactuated hand is only be controlled by two motors yet it can achieve 16 automated configurations. By incorporating the mechanical selector, we were able to increase the versatility of a typical underactuated hand, all conveniently packaged into an average-sized human hand. Utilizing a tendon-based differential pulley system, the hand can also achieve adaptive grasping.

We plan to have the thumb be automatically adjusted, which will multiply the number of automated configurations the hand can produce. It will also be unique to be able to control the stiffness of the antagonistic passive elastic bands.

Acknowledgements

I would like to thank the Soft Robotics and Bionics Lab members and Dr. Yong-La Park for the advice and resources to work on this project, as well as the RISS Program for the opportunity to work here over the summer.

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