

Design and Development of an Antagonist Cable-driven Actuator for Gait Rehabilitation

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Research Objective

- Develop a highly backdrivable, 3D printed actuator, using opposing steel cable pair to transmit torque.
- Achieve a bandwidth ~ 5 Hz closed-loop control bandwidth to potentially assist the hip and the ankle during walking.

Actuator Features

- The actuator design allows most of the assembly to be manufactured using novice 3D printers.
- The actuator uses a 2-stage gear reduction using belt drive and planetary gearbox to simulate a 9:1 reduction ratio at the joint.
- The ring gear of the planetary gear system is repurposed to be used as the cable pulley.

Hardware Overview and Bandwidth Test

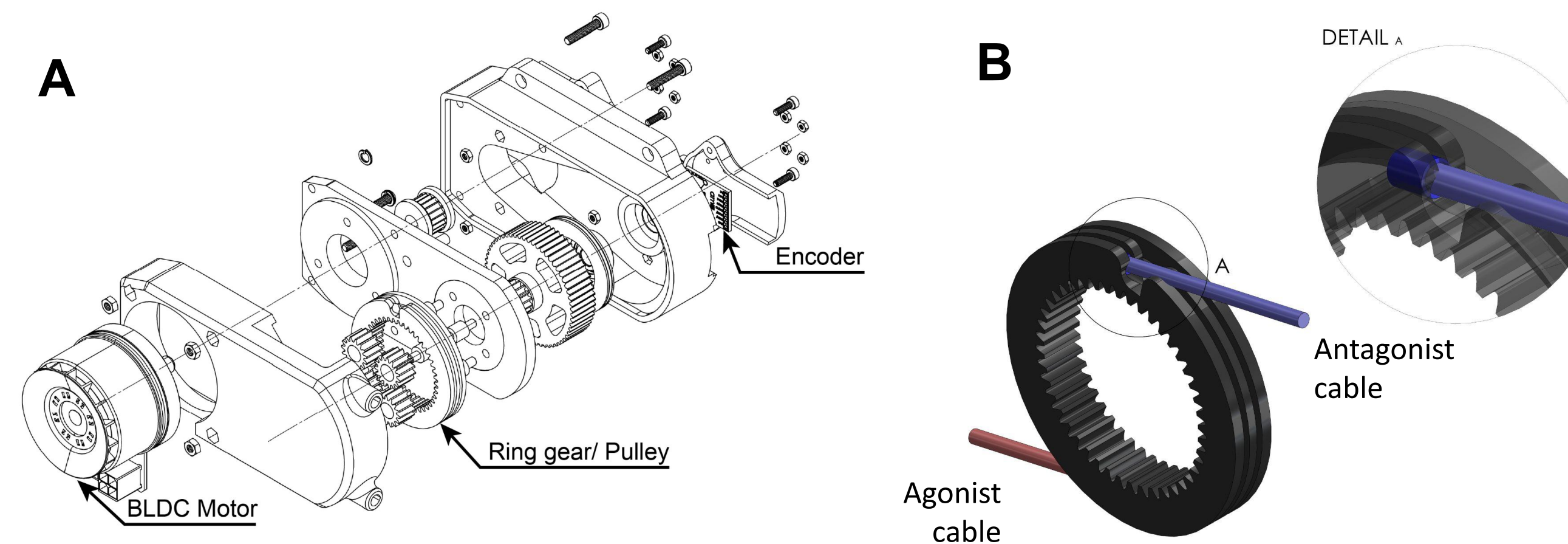


Fig. 1. A: Exploded view of the 3D printed actuator. **B:** Detailed view of antagonist cable pulley.

Fig. 2. A: Closed-loop control structure **B:** Experiment Setup for actuator bandwidth characterization.

Results

Fig. 3. Actuator bandwidth with **(A)** and without **(B)** friction compensation.

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