

Appendix 1

Cable-driven actuator

In the cable-driven actuator, there is a drop in electrical power input due to cable slippage on the pulley, which resulted in missing translational steps. It is observed that the cable-driven actuator consumed more power compared to the work power output due to the tightness of the cable wound around the pulley to reduce slippage.

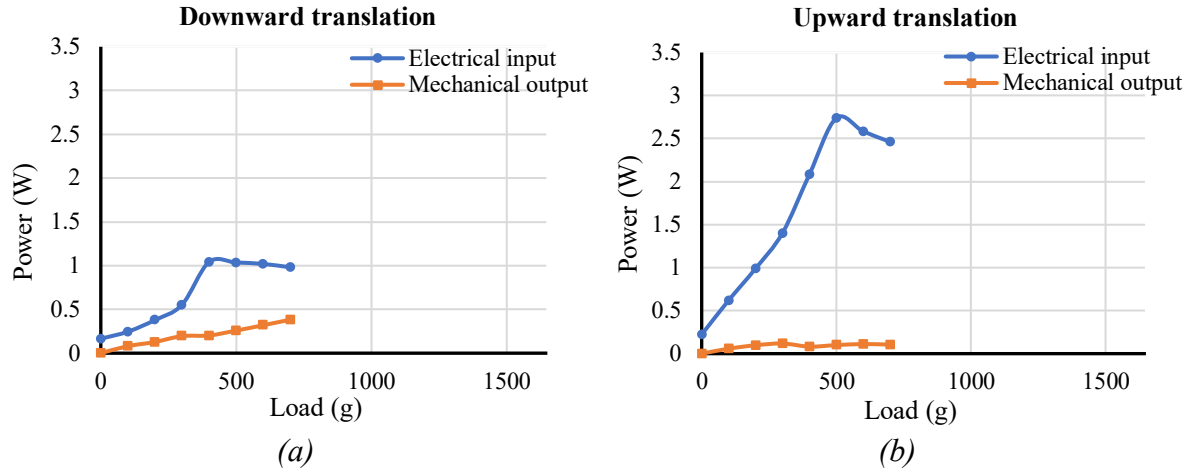
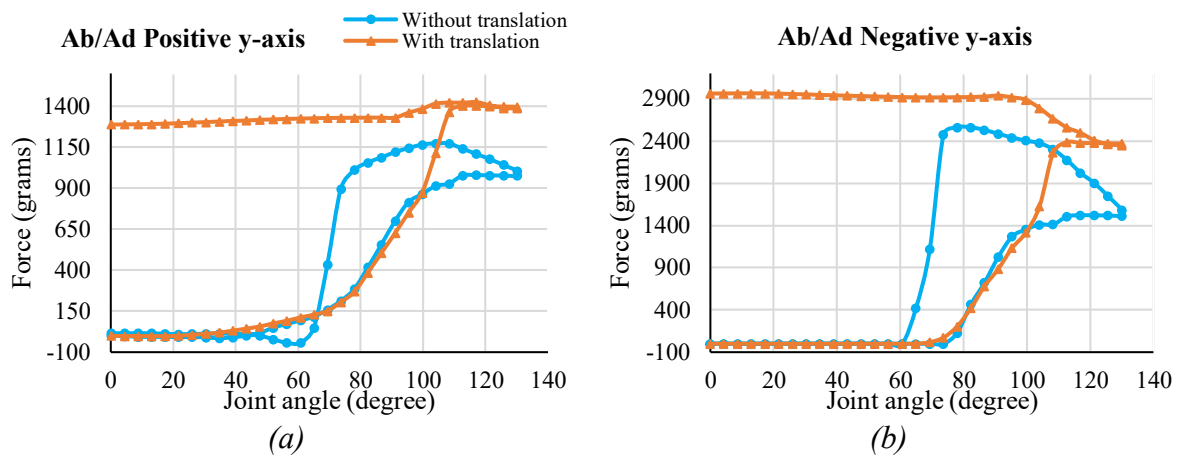


Figure 1. The Power (W) v/s Load (g) plot showing the comparison between the electrical input and the mechanical output for cable transmission-based linear actuator during downward and upward translation is shown in (a) and (b), respectively.

Appendix 2

Conventional exoskeleton-assisted abduction and adduction elevation



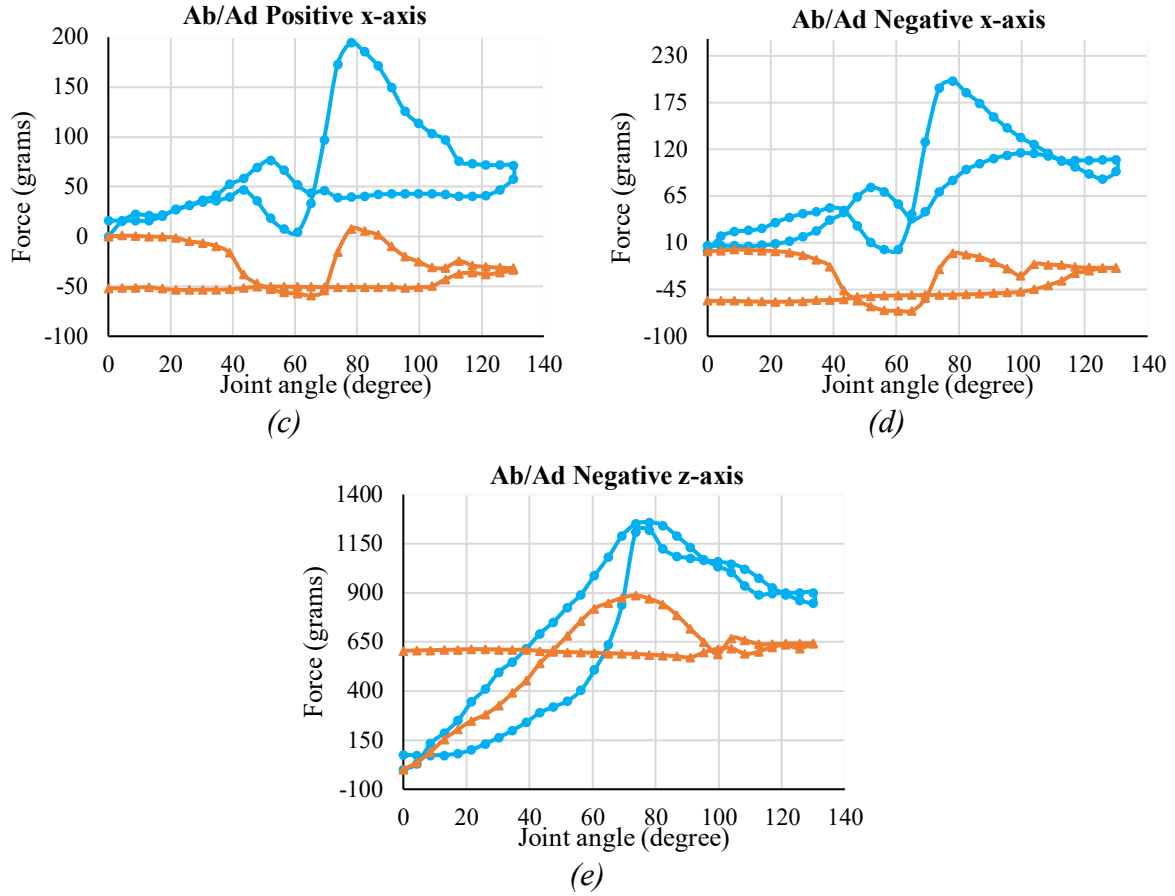


Figure 2. The interaction forces measured while the conventional exoskeleton performs abduction and adduction with the phantom during the two cases, one with translation (shown in orange ▲) of the second spherical joint and the other without translation (shown in blue ●). (a) Shows the interaction force in the positive y-axis, (b) negative y-axis, (c) positive x-axis, (d) negative x-axis and (e) negative z-axis.

Conventional exoskeleton-assisted flexion and extension elevation

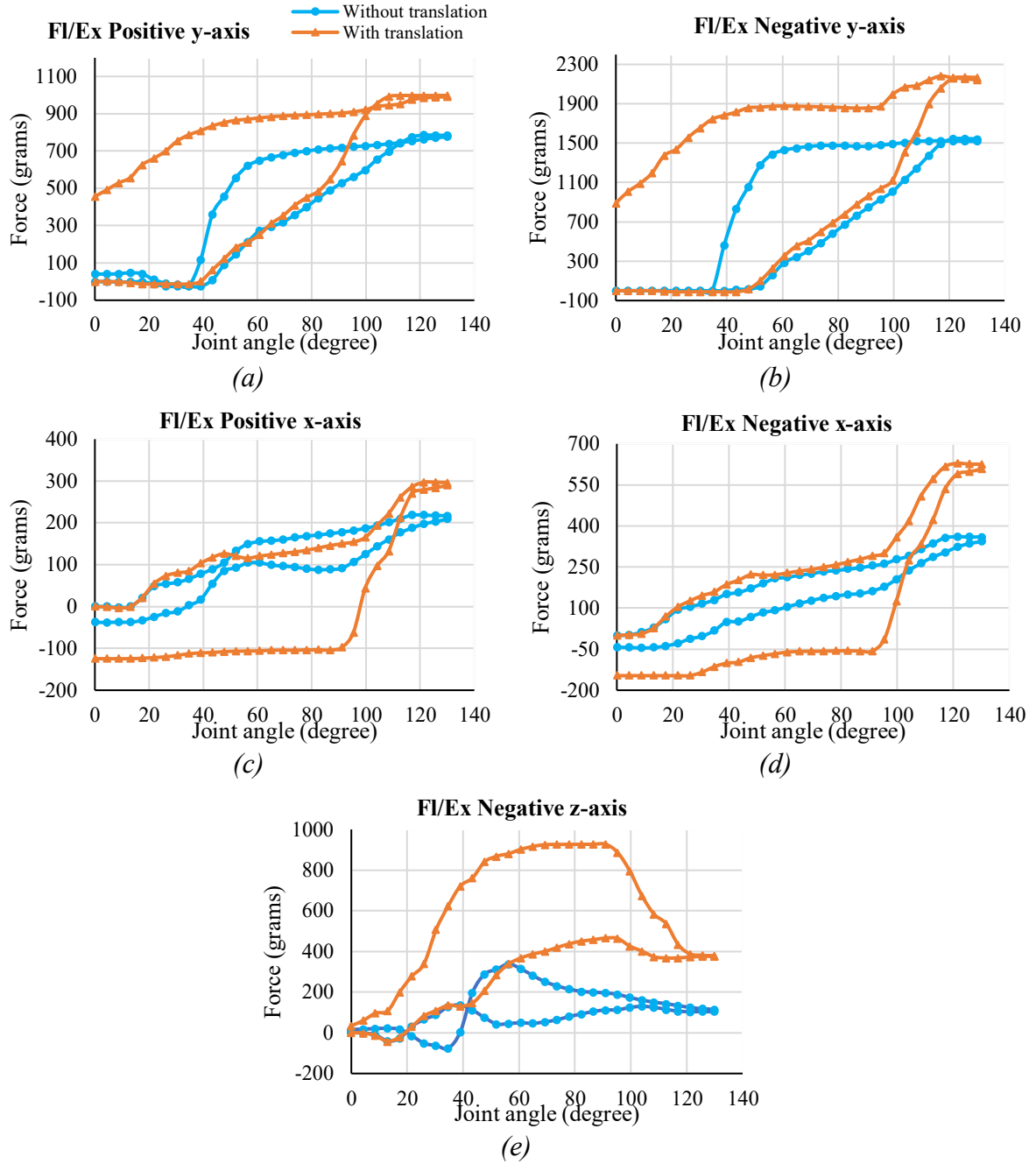


Figure 3. The interaction forces measured while the conventional exoskeleton performs flexion and extension with the phantom during the two cases, one with translation (shown in orange \blacktriangle) of the second spherical joint and the other without translation (shown in blue \bullet). (a) Shows the interaction force in the positive y-axis, (b) negative y-axis, (c) positive x-axis, (d) negative x-axis and (e) negative z-axis.

Human hand-assisted abduction and adduction elevation

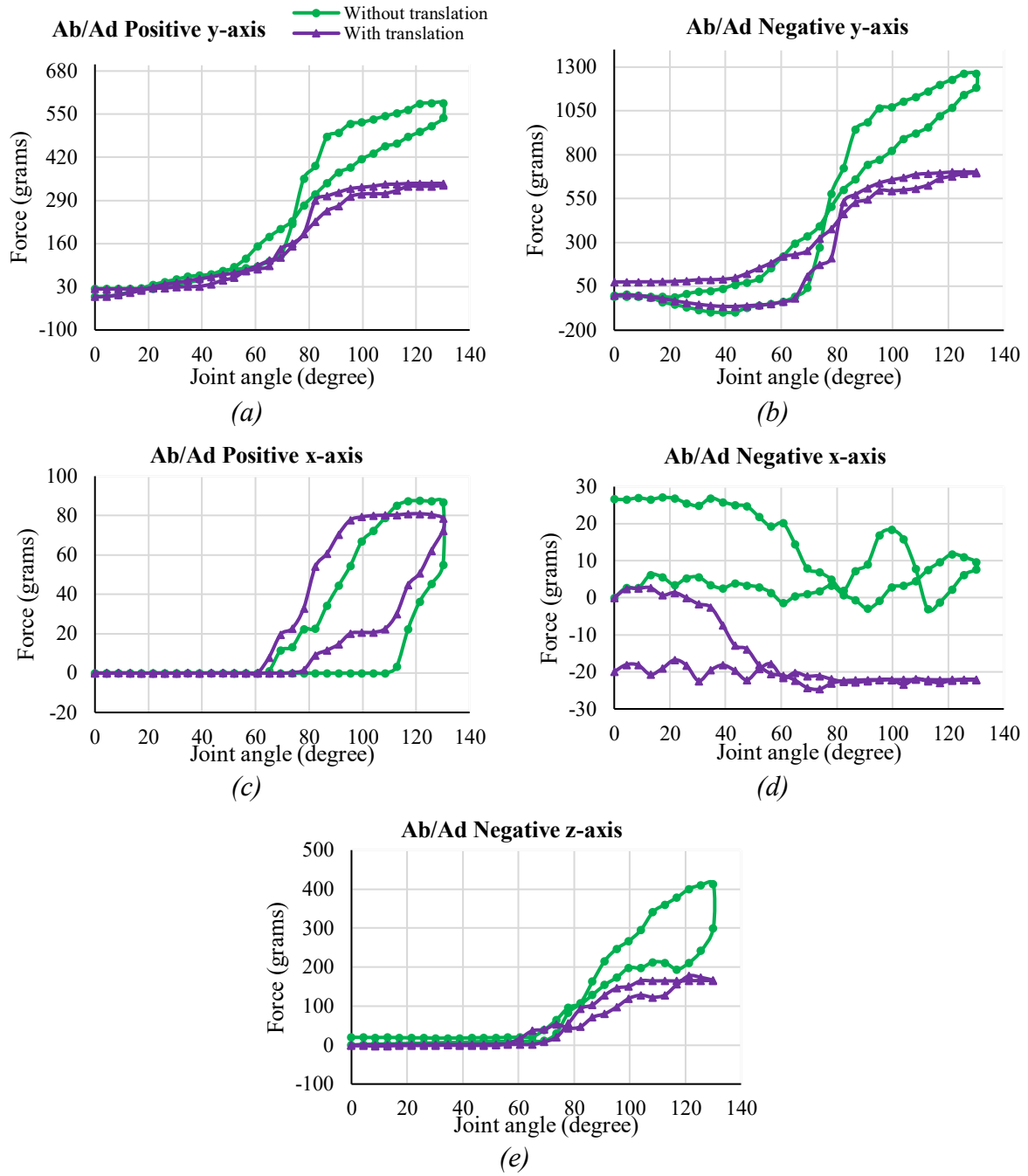


Figure 4. The interaction forces are measured while the human performs abduction and adduction with the phantom during the two cases, one with translation (shown in purple \blacktriangle) of the second spherical joint and the other without translation (shown in green \bullet). (a) Shows the interaction force in the positive y-axis, (b) negative y-axis, (c) positive x-axis, (d) negative x-axis, and (e) negative z-axis.

Human hand-assisted flexion and extension elevation

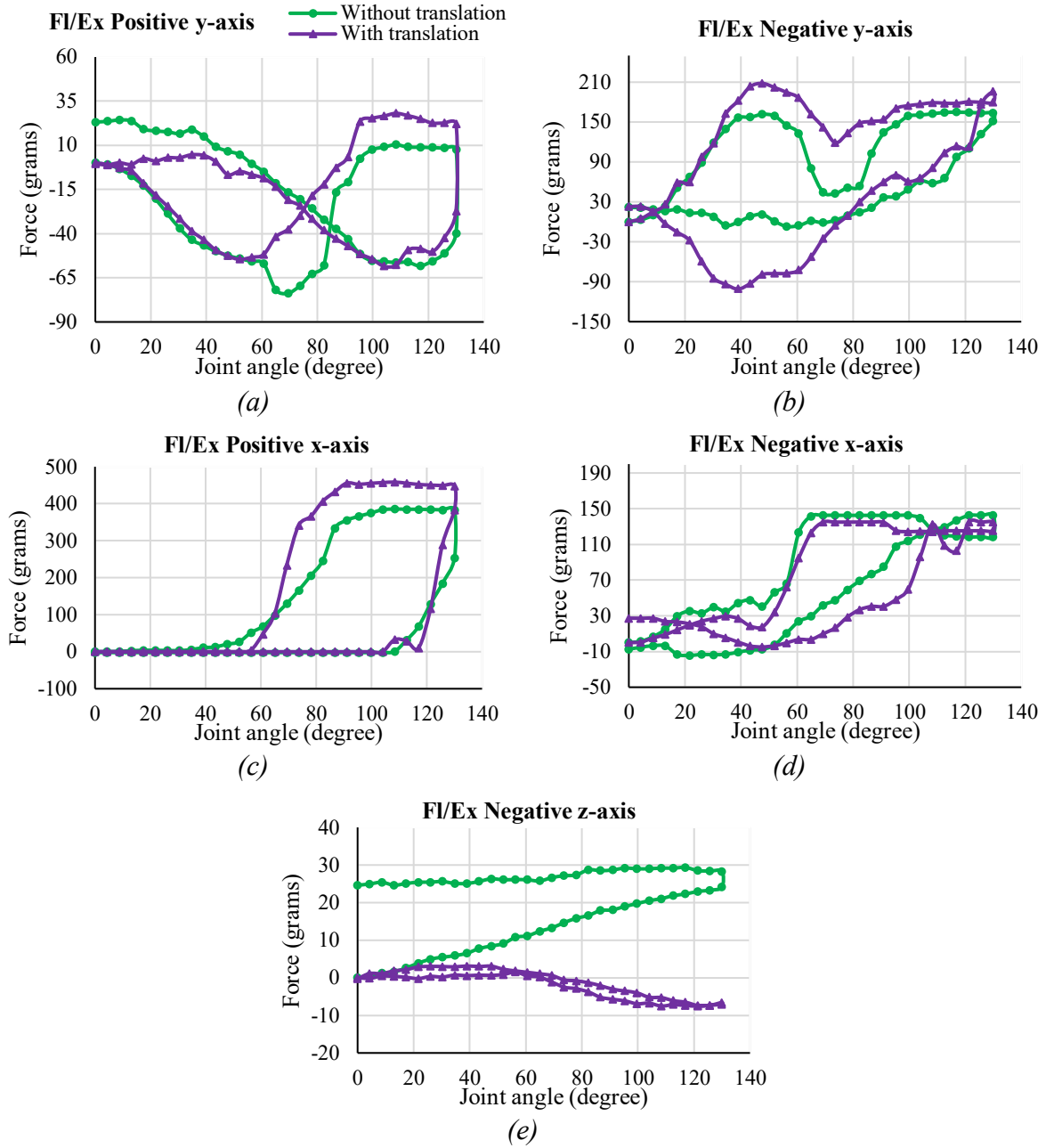


Figure 5. The interaction forces are measured while the human performs flexion and extension with the phantom during the two cases, one with translation (shown in purple ▲) of the second spherical joint and the other without translation (shown in green ●). (a) Shows the interaction force in the positive y-axis, (b) negative y-axis, (c) positive x-axis, (d) negative x-axis, and (e) negative z-axis.

Appendix 3

Experimentation Video Link: <https://drive.google.com/file/d/14JeFb1TuROr-FUjldMRgSGdkyZNG1Mo5/view?usp=sharing>