Analysis and Design of Powered Exoskeleton Technology Emulating Human Body Functions

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Robotic exoskeletons are used to lift heavy weights at the sacrifice of limiting human functions, such as control, range of motion, grasping, and structural integrity. One key to this project is to design and test a robotic exoskeleton with goals to improve on the human functions that were once lost for someone with a maimed or injured arm while keeping the system lightweight and energy efficient. If a system can integrate a hybrid combination of electrical, hydraulic or pneumatic technologies to emulate human body motion and capabilities, then the system can serve as an independent or integrated energy efficient exoskeleton to perform common tasks and improve human functionality. I developed wooden and PVC wrist models that operated due to dual motors on the end effector allowing the system to flex and extend. I applied a weight to the end effectors and then ran the motors at the lowest speed. Both systems lifted a maximum of 407g. I concluded that the motor does not run any slower when higher weights are applied, but won't run if the weight is too high. I tested the servos for control of speed. I was able to control the speed, which will be useful in my final model. The small servos meet the goal of lightweight low energy consumption devices, but are limited in the weight they can lift. I developed a mathematical model for human function. I compared the test data and developed design improvements which will improve the function of an appendage.

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