HOW CAN ACTUATION TIMING AND MAGNITUDE OF A BILATERAL SEMI-RIGID HIP EXOSKELETON OPTIMIZE METABOLIC COST

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Semi-rigid exoskeletons could combine some advantages of rigid and soft approaches. The purpose of this study was to investigate the effects of timing and magnitude of assistance from a semi-rigid hip exoskeleton. For ten participants, we tested ten conditions that were combinations of 5 different end-timings, ranging from 21% to 49%, and 2 different moment magnitudes ranging from 0.06 to 0.12 $Nm.kg^{-1}$. The participants walked in two reference conditions: a condition without actuation and a condition without the exoskeleton. A semi-rigid hip exoskeleton could alter metabolic rate. However, to produce a net assistive effect, it is necessary to design a lighter, more conforming device. In both actuation magnitude levels, the optimal end-timing was close to the maximum range, similar to findings from another study with human-in-the-loop optimization of a soft hip exosuit. This could indicate that the optimal timing with a semi-rigid device is not very different from a fully-soft prototype.