Creating controlled perturbations to study stumble recovery strategies

Dynamic Walking 2017 Poster Abstract

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Falls among amputees are frequent, costly and negatively impact quality of life. Imbalance during walking plays a significant role in amputee falls, which are usually instigated by sudden changes such as pushes, trips or slips during locomotion. Our goals are to identify and demonstrate control algorithms and designs for novel powered prostheses that improve balance recovery in locomotion of transfemoral amputees.

There are a few key steps that outline how we hope to reach our goal. We first want to design and build a system that can help us apply controlled disturbances that would mimic pushes, trips or slips, to understand and characterise reflex recovery strategies of able-bodied subjects. This will allow us to look into how such reflex-like control can be adapted to prosthesis control to improve balance recovery in amputee gait. We then hope to build knee-ankle prosthesis systems capable of the high-performance responses needed for recovery from large disturbances, and eventually evaluate the effectiveness of our proposed controllers in disturbance experiments with amputee subjects.

Our current efforts are focused on the development of the perturbation system, named ‘Pushbot’ which is able to generate controlled pull forces of various magnitudes and profiles at a selected part of a subject’s gait cycle. It initiates these pulls through ropes attached to the subject’s ankles and hip to simulate trips (when pulled backwards at the ankle) and bumps (at the hip).

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