Optimizing Spring-Damper Design in Human Like Walking that is Asymptotically Stable Without Feedback

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Abstract: In recent work, numerical methods employing optimal control algorithms have been used to create biped multibody systems and open loop joint torque histories that create human like walking motions that are asymptotically stable without any feedback. This research has been extended to produce open loop stable biped running, and to produce open loop stable hopping and open loop stable somersaults. In this context, two different numerical algorithms for stability optimization have been developed and will be presented in this talk. In this work, we specifically investigate the role of springs and dampers added to a biped walking system by including the spring and damper constants in the stability optimization. It is shown that the stability robustness to state disturbances of the asymptotically stable open loop gaits can be very substantially increased by an optimization-based selection of spring and damper components.

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