Monitoring the Postural Stability of Planar Bipedal Robots using the Moment-Height Stability Measure

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Abstract - ***Robotics researchers have studied the stability maintenance requirements of bipedal robots since they are inherently unstable. An accurate postural stability measure is required to monitor their dynamic equilibrium conditions. In this article, the novel Moment-Height Stability (MHS) measure, which has previously been developed for monitoring the postural stability of wheeled mobile robots, is developed for that of bipedal robots. The performance of the MHS is evaluated with that of the well-known postural stability measure Zero-Moment Point (ZMP). The MHS and the ZMP are applied to two types of manoeuvres of a planar bipedal robot, consisting of standing up and swinging forward. Simulation results reveal that both the ZMP and the MHS predict the same instant for the occurrence of postural instability for the biped; the MHS warns the biped that the potential of postural instability amplifies once the overall height of the biped center of mass (CM) starts elevating, while the ZMP does so immediately before the occurrence of postural instability.***

Index terms: Bipedal robots; Postural Stability; Moment-Height Stability (MHS); Zero-Moment Point (ZMP); Trajectory Planning.