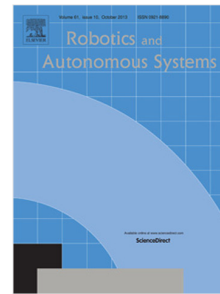


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Bifurcation gait suppression of a bipedal walking robot with a torso based on model predictive control

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Abstract

In our previous work, we have studied a bipedal walking model with a torso, in which the gait evolves from the stable period-1 pattern directly into the Neimark-Sacker bifurcation pattern. Using the Ott-Grebogi-Yorke method, the bifurcation gait could be suppressed into the period-1 gait with higher energy efficiency and walking speed. However, the disturbance rejection ability of the obtained period-1 gait was insufficient, i.e., the basin of attraction was small. In this paper, a new suppression method based on the idea of model predictive control is proposed. Because of the design of the new walking model, which has a time window for computation, and the ability to calculate the walking map quickly, the optimal parameter perturbation can be generated in real time during walking. As a result, the suppression of the bifurcation gait for our bipedal robot can be achieved on-line. This new method not only makes the gait of the controlled model converge to the target period-1 gait with desired high performance, but also guarantees that the obtained gait is better able to reject disturbances.

Keywords: Bipedal walking robot; bifurcation gait suppression; model predictive control; parameter perturbation; Poincaré map

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