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Walking with Capture Steps

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1 Abstract

The contributed video shows a successful real robot implementation of the Capture Step Framework [1] [2]. It was recorded in April 2014 during a public demonstration at the German Open of the RoboCup competition. The Capture Step Framework provides omnidirectional gait control with strong disturbance rejection capabilities. For a versatile control of walking velocity, the command input is a flexible combination of sagittal and lateral translational velocities, as well as a rotational velocity for turning. A linear inverted pendulum-based balance control module computes zero moment point, step timing, and footstep location parameters that implement the commanded velocity, but can deviate from it in order to avoid falling. A variety of disturbances including pushes, collisions, and stepping on objects, can be handled. A precise full-body physical model is not required. Only a kinematic model is used to track a fixed point on the trunk frame of the robot in the center between the hip joints. Trajectory parameters are fitted to data recorded from the real robot in order to obtain accurate predictions of future states using the underlying linear inverted pendulum model. The control output is computed efficiently in closed form.

Fig. 1. Humanoid robot Dynaped regaining balance by stepping forward after a push from the back.

References

1. M. Missura and S. Behnke. Omnidirectional Capture Steps for Bipedal Walking. In *IEEE-RAS Int. Conf. on Humanoid Robots (Humanoids)*, 2013.
2. M. Missura and S. Behnke. Balanced walking with capture steps. In *RoboCup 2014: Robot Soccer World Cup XVIII (to appear)*. Springer, 2014.

http://www.ais.uni-bonn.de/movies/Humanoids_2014_Capture_Step_Walking.wmv