Angular momentum papers  
Inclusion of Angular Momentum During Planning for Capture Point Based Walking

[4] J. Pratt, J. Carff, S. Drakunov, and A. Goswami, “Capture point: A step toward humanoid push recovery,” in IEEE-RAS International Conference on Humanoid Robots (Humanoids), 2006, pp. 200–207.

[10] S.-H. Lee and A. Goswami, “Reaction mass pendulum (rmp): An explicit model for centroidal angular momentum of humanoid robots,” in IEEE International Conference on Robotics and Automation (ICRA), 2007, pp. 4667–4672.

Reduce the full model of the robot to a Reaction mass pendulum. This can be useful for including inertia shaping for the robot, but they don’t provide a way to control the robot for push recovery or bipedal walking.

Model Centroidal momentum.

[11] H. Dai, A. Valenzuela, and R. Tedrake, “Whole-body motion planning with centroidal dynamics and full kinematics,” in IEEE-RAS International Conference on Humanoid Robots (Humanoids), 2014, pp. 295– 302.

Really good paper with really good concepts

“Assuming sufficient control authority (sufficient DOFs away from singularity and strong actuators), the six equations (1a-1b) are also sufficient conditions for planning dynamically feasible motions. Many robots, including most humanoids, have actuators for every internal joint; in that case, for any desired joint acceleration there is always a joint torque to achieve such motion. As a result, if we ignore force/torque limits of the actuators, then we can ignore the internal, joint-level dynamics of the robot. Thus the six equations (1a-1b), which relate the external wrenches to the overall momentum of the robot, are necessary and sufficient to describe the dynamics of the robot. This dynamics model is much simpler than the full-body model, with fewer constraints (n+ 6 to 6), and fewer variables, as the joint torques can be computed subsequently using inverse dynamics.”

“Together, these observations highlight a continuum of algorithms which range from using simple dynamics to full dynamics, and/or simple kinematics to full kinematics. In this paper we explore a powerful middle ground, with simple dynamics and full kinematics.”

[12] A. Herzog, N. Rotella, S. Schaal, and L. Righetti, “Trajectory generation for multi-contact momentum control,” in IEEE-RAS 15th International Conference on Humanoid Robots (Humanoids), 2015, pp. 874–880.

There has been a great success in controlling robots based on momenta [14] [13], including the resolved momentum control framework proposed by Kajita et. al. [11] [18].

Kajita, S. Kanehiro, F. Kaneko, K. Fujiwara, K. Harada, K. Yokoi, K. Hirukawa, and H. Resolved momentum control: humanoid motion planning based on the linear and angular momentum. Intelligent Robots and Systems (IROS), Proceedings, 2003.Shows a framework for controlling momentum based on Contact Wrench Cones.

The effect of centroidal angular momentum during the human gait cycle has been studied in [9].

[9] H. Herr and M. Popovic, “Angular momentum in human walking,” Journal of Experimental Biology, vol. 211, no. 4, pp. 467–481, 2008

Caron’s work:

Biped Stabilization by Linear Feedback of the Variable-Height Inverted Pendulum Model:

Feedback tracking of the desired trajectories of the Model using QP