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Comparison of kinematic and dynamic leg trajectory optimization techniques for biped robot locomotion

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Abstract

The paper presents comparison analysis of two approaches in defining leg trajectories for biped locomotion. The first one operates only with kinematic limitations of leg joints and finds the maximum possible locomotion speed for given limits. The second approach defines leg trajectories from the dynamic stability point of view and utilizes ZMP criteria. We show that two methods give different trajectories and demonstrate that trajectories based on pure dynamic optimization cannot be realized due to joint limits. Kinematic optimization provides unstable solution which can be balanced by upper body movement.

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References

- [1] Akhtaruzzaman M. and Shafie A. A. 2010 Control Automation and Systems (ICCAS) 1021-1028
- [2] Goswami A. 1999 The International Journal of Robotics Research 18 523-533
- [3] Escande A., Kheddar A. and Miossec S. 2013 Robotics and Autonomous Systems 61 428-442
- [4] Katić D. and Vukobratović M. 2003 Journal of Intelligent and Robotic Systems 37 117-141
- [5] Khusainov R., Shimchik I., Afanasyev I. and Magid E. 2015 Informatics in Control, Automation and Robotics (ICINCO), 2015 12th International Conference on 02 141-148
- [6] Römer U. J., Kuhs C., Krause M. J. and Fidlin A 2016 IEEE International Conference on Robotics and Automation (ICRA) 1374-1381
- [7] Wolff K., Sandberg D. and Wahde M 2008 IEEE Congress on Evolutionary Computation (IEEE World Congress on Computational Intelligence) 440-445
- [8] Yussof H., Ohka M., Yamano M. and Nasu Y. 2008 Modeling & Simulation AICMS 08 564-569
- [9] Nakamura M. 2004 "Trajectory planning for a leg swing during human walking".
- [10] Kaminaga H., Englsberger J and Ott C. 2012 International Conference on Humanoid Robots 593-599
- [11] Khusainov R., Klimchik A. and Magid E. 2016 Informatics in Control, Automation and Robotics (ICINCO), 2016 13th International Conference on
- [12] Gabbasov B., Danilov I., Afanasyev I. and Magid E. 2015 2015 10th International Symposium on. 1-6 Mechatronics and its Applications (ISMA)
- [13] Ha T. and Choi C.-H 2007 Robotics and Autonomous Systems 55 795-810