



SAPIENZA
UNIVERSITÀ DI ROMA

DEPARTMENT OF COMPUTER, CONTROL AND MANAGEMENT
ENGINEERING

Real-Time Safe Bipedal Robot Navigation using Linear Discrete Control Barrier Functions

AUTONOMOUS AND MOBILE ROBOTICS

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1 Introduction

Eugenio:

Humanoid robots are inherently underactuated thanks to unilateral ground contacts thus a strong coupling exists between path planning and gait control. A path is considered safe if the robot does not collide with any obstacle and its dynamics and physical limitations are respected. Due to the high complexity of humanoids, we cannot decouple path planning from motion control without taking into account the dynamics. We should solve gait optimization problems based on the robot's full order model or the reduced one. Due to computational complexity, reduced order models such the Linear Inverted Pendulum (LIP) are often employed. In our case, since Control Barrier Functions are employed to ensure safety in path planning, we will pre-compute heading angles and use approximated linear DCBFs. This is needed since we may have problems at computation level due to the non linearity of kinematics and path constraints.

[1]

2 Conclusion

This is the conclusion.

References

- [1] Ping Hsu, John Mauser, and Shankar Sastry. Dynamic control of redundant manipulators. *Journal of Robotic Systems*, 6(2):133–148, 1989.
- [2] Luigi Villani Giuseppe Oriolo Bruno Siciliano, Lorenzo Sciavicco. *Inverse Differential Kinematics*, chapter 3.5, pages 123–128. Springer, 2009.