Long-Horizon Vehicle Motion Planning and Control Through Serially Cascaded Model Complexity

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Abstract

We propose the implementation and experimentation of a motion planning and control framework for autonomous vehicles based on nonlinear model-predictive control.The work is mainly based on [Laurense and Gerdes, 2022]. The code is available publicly at this GitHub repository.

1 Introduction

- Overview of the paper
- Problem statement
- Literature review (?)
- Report outline

Overview of the paper

Nonlinear model predictive control (NMPC) is a powerful tool for the control of systems with a nonlinear dynamics that tries to predict the evolution of the system over a prediction window. It is based on a cost function, which must be minimized at each time step according to a set of constraints. One of its highest problem is the computational power it can require. This entails the need of a high-performance hardware to solve the optimization problem in an acceptable time, but sometimes for high nonlinear dynamics systems this is not enough. Especially in a real environment, where the timeliness is fundamental to take a decision.

2 Methodology

- Concept of MPC for vehicle control
- Concept of serially cascaded models

3 Implementation

- Tools and libraries
- Description of implementation process
- Modifications or adaptations wrt the paper

4 Experimental Setup

- Simulation setting (track etc.)
- Different configuration scenarios

5 Results

- Guess what

6 Conclusion

- Take-away message
- Pitfalls and future work

References

[Laurense and Gerdes, 2022] Laurense, V. A. and Gerdes, J. C. (2022). Long-horizon vehicle motion planning and control through serially cascaded model complexity. *IEEE Transactions on Control Systems Technology*.