

Optimal Control Algorithms for Automatic Driving

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Abstract: The test-drive of an automobile along a given test-course can be modeled by formulating a suitable optimal control problem. This approach allows to model different types of drivers which behave optimally with respect to the objective function being used in the optimal control problem. We will propose solution techniques for the resulting highly nonlinear state constrained optimal control problems and discuss possibilities and challenges in view of their integration in a real car. The solution techniques are based on a direct discretization approach in combination with a model predictive control algorithm. Extensions towards optimal control problems with mixed-integer control variables and real-time optimal control problems will be presented. Numerical results for test-courses with complicated structure like the Hockenheim race track and experiences with an automatically driven existing prototype car will be reported.

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