Pitfalls and Solutions in Nonlinear Model Predictive Control

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Abstract:

Firstly, we briefly recap the basic ideas underlying Model Predictive Control (MPC). Then, we consider the example of the mobile robot. This example is of particular interest due to its non-holonomic nature, which makes the stabilization task challenging according to A. Astolfi, see [1]. In particular, it was shown in [2] that the set-point stabilization problem cannot be solved using MPC based on purely quadratic costs without stabilizing terminal constraints or costs. A remedy is the use of tailored stage or terminal costs, see, e.g. [3]. In the first part of the talk we recap these findings. Then, we present the framework proposed in [4], which allows to systematically design stage costs such that local asymptotic stability of the origin w.r.t. the MPC closed loop is ensured for a class of systems including the robot example. To this end, we show that cost controllability, i.e. a sufficient stability condition, holds making use of the homogeneous approximation.