



# CSC Seminar

## SPEAKER

**Karl Worthmann**

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## TITLE

**On the design of MPC controllers for non-holonomic systems**

## ABSTRACT

The stabilization of non-holonomic mobile robots is challenging according to A. Astolfi, see [1]. In particular, it was shown in [2] that the set-point stabilization cannot be achieved using MPC based on quadratic costs without stabilizing terminal conditions. 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 system class including the mobile-robot example. To this end, we show that cost controllability, a sufficient stability condition, holds provided that the homogeneous approximation is null controllable.

[1] A. Astolfi: Discontinuous control of nonholonomic systems. *Systems & Control Letters* 27(1): 37-45, 1996.

[2] M.A. Müller, K. Worthmann: Quadratic costs do not always work in MPC. *Automatica* 82: 69-277, 2017.

[3] K. Worthmann, M.W. Mehrez, M. Zanon, G.K.I. Mann, R.G. Gosine, M. Diehl: Model predictive control of nonholonomic mobile robots without stabilizing constraints and costs. *IEEE Transactions on Control Systems Technology* 24(4): 1394-1406, 2016.

[4] J.-M. Coron, L. Grüne, K. Worthmann: Model Predictive Control, Cost Controllability, and Homogeneity. *SIAM Journal on Control and Optimization* 58(5): 2979-2996, 2020.

Monday, February 13, 2023 at 2 pm  
seminar room Prigogine