

# Approximate Dynamic Programming for Robust Model Predictive Control

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**Abstract:** We present a novel method to synthesize a robustly stable constrained feedback law, based on model predictive control (MPC) for polytopic systems with linear constraints. In contrast to previous approaches to robust MPC, our method does not require any prior knowledge of a locally stabilizing feedback law at the origin. Instead, a robust dynamic programming approach – that we recently developed [3] – is used to generate automatically a robustly invariant set and a control Lyapunov function, along with the nonlinear constrained feedback law. While the exact method is prohibitively expensive in practice due to its combinatorial complexity, we use an approximation technique with bounded errors [1] (both methods are publicly available [2]). At the end of the talk we present a new concept for robust stability certificates, the “uroborus”, and sketch how it allows to generate robustly stable MPC laws.

## References:

- [1] Jakob Björnberg and Moritz Diehl. Approximate robust dynamic programming and robustly stable MPC. Technical Report 2004-41, SFB 359, University of Heidelberg, 2004. (provisionally accepted at Automatica).
- [2] Jakob Björnberg and Moritz Diehl. The software package RDP for robust dynamic programming. <http://www.iwr.uni-heidelberg.de/~Moritz.Diehl/RDP/>, January 2005.
- [3] M. Diehl and J. Björnberg. Robust dynamic programming for min-max model predictive control of constrained uncertain systems. *IEEE Trans. Automat. Contr.*, 49(12):2253–2257, 2004.

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