

Accepted Manuscript

Accelerating linear model predictive control by constraint removal

Michael Jost, Gabriele Pannocchia, Martin Mönnigmann

PII: S0947-3580(17)30068-7
DOI: [10.1016/j.ejcon.2017.02.003](https://doi.org/10.1016/j.ejcon.2017.02.003)
Reference: EJCON 197

To appear in: *European Journal of Control*

Received date: 6 October 2014
Revised date: 30 January 2017
Accepted date: 13 February 2017

Please cite this article as: Michael Jost, Gabriele Pannocchia, Martin Mönnigmann, Accelerating linear model predictive control by constraint removal, *European Journal of Control* (2017), doi: [10.1016/j.ejcon.2017.02.003](https://doi.org/10.1016/j.ejcon.2017.02.003)



This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Accelerating linear model predictive control by constraint removal

Michael Jost^a, Gabriele Pannocchia^b, Martin Mönnigmann^{a,*}

^aAutomatic Control and Systems Theory, Ruhr-Universität Bochum,
Universitätsstraße 150, 44801 Bochum, Germany

^bDepartment of Civil and Industrial Engineering, University of Pisa,
Largo Lucio Lazzarino, 2, 56126 Pisa, Italy

Abstract

Model predictive control (MPC) is computationally expensive, because it is based on solving an optimal control problem in every time step. We show how to reduce the computational cost of linear discrete-time MPC by detecting and removing inactive constraints from the optimal control problem. State of the art MPC implementations detect constraints that are inactive for all times and all initial conditions and remove these from the underlying optimization problem. Our approach, in contrast, detects constraints that become inactive as a function of time. **More specifically, we show how to find a bound σ_i^* for each constraint i , such that a Lyapunov function value below σ_i^* implies constraint i is inactive. Since the bounds σ_i^* are independent of states and inputs, they can be determined offline.** The proposed approach is easy to implement, **requires simple and affordable preparatory calculations**, and it does not depend on the details of the underlying optimization algorithm. We apply it to two sample MPC problems of different size. The computational cost can be reduced considerably in both cases.

Keywords: model predictive control, linear systems, constrained control, quadratic programming

1. Introduction

Model predictive control (MPC) is a powerful method for the control of constrained, multivariable systems. Because MPC requires to solve optimal control problems online, it is computationally expensive, however. For the common case of linear systems, linear constraints and quadratic objective functions, the problem to solve is a Quadratic Program (QP), and the control law implicitly

*Corresponding author. Tel.: +49 234 32 24060

Email addresses: michael.s.jost@rub.de (Michael Jost), gabriele.pannocchia@unipi.it (Gabriele Pannocchia), martin.moennigmann@rub.de (Martin Mönnigmann)

Download English Version:

<https://daneshyari.com/en/article/5001713>

Download Persian Version:

<https://daneshyari.com/article/5001713>

[Daneshyari.com](https://daneshyari.com)