Institut für Regelungstechnik
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Prof. Dr.-Ing. M.Müller

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System and Control Seminar

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Minimax strategy in approximate model predictive control

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Abstract

Model predictive control (MPC) provides a tractable way of calculating control actions that optimize some measure of performance while ensuring that the states and inputs satisfy some prescribed set of constraints. While an MPC formulation of a control problem might be attractive from a theoretical point of view, practical implementations are often limited. This is due to extensive computational resources required for exactly solving the optimization problem at each time step. The Explicit MPC framework was developed to address this issue and reduce the resources needed to compute the control law at each time step. However, it comes with the added cost of increased memory storage, as well as, the need to solve a computationally expensive point location problem. One way to alleviate the difficulties associated with solving such point location problems is to try to approximate the solution of Explicit MPC over a partitioned state space. The main challenge faced in implementing such approximate solutions is ensuring that the system remains stable while the state and input constraints remain satisfied. The contributions of the approach introduced in this talk are as follows. First, a new methodology for calculating an approximate solution is developed. Second, a test, that entails solving a finite number of convex optimization problems, for ensuring the stability of the system is proposed. Furthermore, it is shown that the proposed approach together with an anisotropic partitioning scheme greatly improves upon the state-of-the-art in the area of Approximate Explicit MPC in terms of size of the state space partitioning. The efficacy of the approach is also demonstrated through the application to a balancing robot.

Biographical information

Andrei Pavlov is currently a PhD student at the Department of Electrical and Electronic Engineering, the University of Melbourne, Australia. He received his M.Sc. degree in Physics from Lomonosov Moscow State University, Russia. His current research interests include numerical optimization and its applications to optimal control.