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SEQUENTIAL DESIGN OF ROBUST OUTPUT MODEL PREDICTIVE CONTROL

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Abstract. *The paper addresses the problem of designing a robust parameter dependent quadratically stabilizing output/state feedback model predictive control for linear polytopic systems without constraints using original sequential approach. For the closed-loop uncertain system, the design procedure ensures stability, robustness properties and guaranteed cost.*

Keywords: Model predictive control, Robust control, Parameter dependent quadratic stability, Lyapunov function, Polytopic system, Sequential approach

1. **Introduction.** Model predictive control (MPC) has attracted notable attention in control of dynamic systems. The idea of MPC can be summarized as follows, (Camacho and Bordons [3], Maciejovski [12], Rossiter [20]):

- Predict the future behavior of the process state/output over the finite time horizon.
- Compute the future input signals on line at each step by minimizing a cost function under inequality constraints on the manipulated (control) and/or controlled variables.
- Apply on the controlled plant only the first of vector control variable and repeat the previous step with new measured input/state/output variables.

Therefore, the presence of the plant model is a necessary condition for the development of the predictive control. The success of MPC depends on the degree of precision of the plant model. Two typical description of model uncertainty, state space polytope and bounded unstructured uncertainty, are extensively considered in the field of robust model predictive control. Most of the existing techniques for robust MPC assume measurable state, and apply plant state feedback or when the state estimator is utilized output feedback is applied. Some results in the field of robust MPC design can be summarized as follows:

Analysis of robustness properties of MPC. For SISO systems and impulse response model Zafiriou nad Marchal [23] have used the contraction properties of MPC to develop necessary-sufficient conditions for robust stability of MPC with input and output constraints. Polak and Yang [16], have analyzed robust stability of MPC using a contraction constraint on the state.

MPC with explicit uncertainty description. For SISO FIR plants, Zheng and Morari [25] have presented robust MPC schemes with uncertainty bounds on the impulse response coefficients. Some MPC approaches consider additive type of uncertainty, de la Pena et al. [15] or parametric (structured) type uncertainty using CARIMA model and linear matrix inequality, Bouzouita et al. [2]. In Wang et al. [24], the GPC design technique