International Journal of Innovative
Computing, Information and Control
Volume **5**, Number **4**, April **2009**

ICIC International ©2009 ISSN 1349-4198
pp. 1115–1123

ROBUST OUTPUT MODEL PREDICTIVE CONTROL DESIGN: BMI APPROACH

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Received January 2008; revised May 2008

Abstract. *The paper addresses the problem of designing robust output feedback model predictive control to one-step ahead prediction horizon which ensures a parameter dependent quadratic stability and guaranteed cost for the case of linear polytopic systems.*
Keywords: Model predictive control, Robust control, Polytopic system, Parameter dependent quadratic stability, Lyapunov function

1. **Introduction.** Model predictive control (MPC) has attracted notable attention in control of dynamic systems. The idea of MPC , (Camacho and Bordons; Maciejovski; Rositer)[3],[14],[23] can be outlined by the next scheme:

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

The presence of the plant model is a necessary condition for the predictive control and the success of MPC depends on precision of the plant model. The principal shortcoming of existing MPC-based control techniques in the most references is their inability to explicitly incorporate plant model uncertainty, Kothare et al, [9],[8].
Thus, the present state of robustness problem in MPC can be summarized as follows:

- Analysis of robustness properties of MPC.
  Zafiriou nad Marchal, in [25] have used the contraction properties of MPC to develop necessary-sufficient conditions for robust stability of MPC with input and output constraints for SISO systems and impulse response model. Polak and Yang, in [20] have analyzed robust stability of MPC using a contraction constraint on the state. The Constraint Tightening proposed in Grossner et al [7], Kuwata et al, [10] is based on the idea of increasing the robustness of the controller by tightening the constraints on the predicted states.
- MPC with explicit uncertainty description.
  Zheng and Morari in [27], have presented robust MPC schemes for SISO FIR plants, with given uncertainty bounds on the impulse response coefficients. Some MPC consider additive type of uncertainty, de la Pena et al, in [18], or parametric (structured) type uncertainty using CARIMA model and linear matrix inequality, Bouzouita et al, in [2]. In Lovaas et al, in [12] the unstructured uncertainty is used for open-loop