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ROBUST CONTROL OF NETWORKED PREDICTIVE CONTROL SYSTEM WITH PERTURBATION IN THE NONLINEAR PROCESS

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Abstract. This paper studies the robust control problem of a class of Networked Predictive Nonlinear Control Systems (NPNCS), where the nonlinear process is linearisable and contains non-vanishing perturbations. The robust control of the NPNCS is considered. An event-driven networked predictive controller is applied to stabilise the system. A method is developed to study the stability of the closed-loop unperturbed system by formulating the problem as a sub-optimal problem constrained by a series of inequalities. This method is also generalised to the robust stability analysis of the perturbed NPNCSs. The efficiency of the control scheme is illustrated using a numerical example.

Keywords. networked control system, nonlinearity, perturbation, robust control, time-delay

1 Introduction

In recent years, Networked Control system (NCS) is a research topic that has attracted significant interest from researchers. Using networks as a data transmission media brings significant benefits to implementing control schemes. However, for a successful implementation of NCS there are also problems that need to be addressed, such as time-delay, data dropout and data disorders[3, 14, 16]. Research papers reporting a number of methods to deal with these problems are surveyed in [3, 14-16] and the references therein. However, NCS research is still in its infancy. As pointed out in [15], there are only limited results published on the stability of systems with plant uncertainties and none relating to Networked Nonlinear Control System (NNCS). This paper studies the robust control of a class of nonlinear NCS with non-vanishing perturbations in the nonlinear plant.

In the co-authors previous work [4-7], a networked predictive control scheme is proposed which deals with the problems induced by insertion of the network. The robust stability analysis of the networked predictive control system has also been studied [11]. A method for designing the networked predictive controller is also presented. The control scheme is not only able to deal with the above network-induced problems, but also able to robustly stabilise the linear system. Furthermore, in [12] the authors also proposed a control scheme to deal with the problems relating to the implementation of NNCS and to analyse the closed-loop stability.