

NETWORKED PREDICTIVE CONTROL OVER GPRS WIRELESS NETWORKS

S.C. Chai¹, G.P. Liu^{1,2}, K. Malhotra¹ and D. Rees¹

¹Faculty of Advanced Technology, University of Glamorgan
Pontypridd CF37 1DL, UK

²Center for Control Theory and Guidance Technology,
Harbin Institute of Technology, China

Abstract. This paper provides a networked predictive control (NPC) method for control systems over general packet radio service (GPRS) networks. The NPC method can actively compensate for the network delay and data dropout, which is well known to seriously degrade the performance of control systems. This method is an improved and intelligent implementation of the model based predictive control (MPC) method. A control prediction sequence is generated using the MPC strategy and an appropriate control prediction is chosen from the sequence according to the network delay and data dropout. The stability of the closed-loop networked predictive control system is also discussed. Simulations and practical experiments results show that the proposed control strategy can efficiently improve the performance of control systems over GPRS wireless networks.

Keywords. Networked Predictive Control, General Packet Radio Service, network delay, data dropout, wireless network

AMS (MOS) subject classification: 49N35.

1 Introduction

Recently, wireless networked control systems (NCSs) have been becoming a rapid growing sector in control theory and industrial applications [1, 2, 23], particularly in the automotive and aeronautical industries where many sensors and actuators are placed at different locations. In the wireless networked control systems, wireless communication networks are employed to exchange sensor signals and control signals between control system components [3, 4]. There are many attractive advantages of introducing wireless networks to the control systems, for example, wireless network control not only can reduce the cost and time needed for the installation and maintenance, but also can greatly minimize the installation space of the whole control system. Beside these, easy reconfiguration is another highlight characteristic of the wireless network control [5-7]. Therefore much attention has been given to the researches on wireless network control systems [24, 25].

GPRS is a bearer service for the Global System Mobile Communication (GSM) which improves and simplifies wireless access to data networks [8].