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STABILIZATION OF NETWORKED CONTROL SYSTEMS IN THE PRESENCE OF PACKET LOSSES

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Abstract. The problem of stabilization of networked control systems (NCSs) in the presence of packet losses is studied. Sufficient conditions on the stability and stabilization of the NCSs are presented. Stabilizing state feedback controllers can be constructed by using the feasible solution of some linear matrix inequalities (LMIs). The novelty of this work is that the NCSs with arbitrary but finite data packet dropout are modelled as switched linear systems, and this enables us to apply the existing theories of switched systems to the analysis of such NCSs. A simulation example is worked out to illustrate the effectiveness of the proposed method.

Keywords. Networked control systems, packet losses, stabilization, LMIs, switched linear systems.

AMS (MOS) subject classification: 94C99, 93C62, 15A39, 93D15.

1 Introduction

Networked control systems (NCSs) is a special class of hybrid systems wherein the control loops are closed through communication networks. Compared with conventional point to point control systems, the advantages of NCSs are less wiring, lower install cost as well as greater agility in diagnosis and maintenance. Examples include industrial automation, intelligent vehicle systems and advanced aircraft and spacecraft, etc. However, due to network channel nondeterminism, the controller may not be able to receive all of the plant output updates at the time of the control calculation. Therefore, the insertion of communication network in the feedback control loop complicates the analysis and design of the NCSs.

Packet losses often happen due to link failure or purposefully dropped packets in order to avoid congestion or guarantee the most recent data to receiver. In the study of NCSs, much effort has been devoted to deal with the problem of network delays [3, 6], while less attention has been paid to the impact of data packet dropout, which may also be a potential source of instability and poor performance of the NCSs because of the critical real-time requirement in control systems [1, 5, 7]. Therefore construction of feedback controllers to stabilize NCSs with data packet dropout is very essential to the real application. The issue of data packet dropout