

NETWORK QUALITY-OF-SERVICE BASED GUARANTEED COST CONTROL FOR NETWORKED CONTROL SYSTEMS

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Abstract. Control over communication networks has received increasing interest in recent years. The performance of the feedback control implemented in networked control systems (NCSs) is directly dependent on network Quality-of-Service (QoS). The time-varying characteristics of the QoS degrade the control performance and introduce distortion to controller signals. Addressing this problem, this paper proposed guaranteed cost control for NCSs based on network QoS. An approach was developed for codesign of feedback control and network QoS. The effectiveness of the proposed method was illustrated through a numerical example.

Keywords. Gain scheduling; QoS; Maximum allowable equivalent delay bound; Guaranteed cost control.

1 Introduction

The potential of using data networks for real-time, high-performance control and automation has been well recognised. Control over networks has the advantages of low cost, simple installation and maintenance, reliable operation, etc., although design and implementation of networked control systems (NCSs) are still challenging [6, 15, 16]. Fundamentals of NCSs over communication networks can be found in [5, 6, 15, 16].

In investigation into various aspects of NCSs, much attention has been paid recently to the control design with consideration of NCS Quality-of-Service (QoS) [3, 7, 14]. This results from the observation that the performance of NCS feedback control is tightly coupled with the QoS that the communication networks can provide. Obviously, two types of QoSs need to be considered in designing an NCS, i.e., QoS of the communication networks of the NCS, and QoS of the overall NCS control loops including the communication networks and the controller. Due to the time-varying characteristics