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STATE FEEDBACK H_∞ CONTROL FOR NETWORKED CONTROL SYSTEMS WITH QUANTIZATION AND RANDOM COMMUNICATION DELAYS

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Abstract. *In this paper, the state feedback H_∞ control problem for networked control systems with quantization and random communication delays is discussed. The random delays from the sensor to the controller and from the controller to the actuator are considered. The quantizer considered here is dynamic and composed of an adjustable zoom parameter and a static quantizer. A novel quantized random delay model is proposed, and by using this model, the relationship of the quantizations, delays and the system performance is studied. The state feedback H_∞ controller can be constructed via solving a linear matrix inequality. With a condition on the quantization range and the error bound satisfied, a quantized H_∞ control strategy is derived such that the closed-loop system with quantization and random delays exponentially mean-square stable and with a prescribed H_∞ performance bound. An example is presented to illustrate the effectiveness of the proposed method.*

Keywords: Network control systems, Quantization, Random communication delays, Linear matrix inequality, Quantized H_∞ control strategy

1. **Introduction.** Networked control systems (NCSs) have received increasing attention in recent years due to many advantages including lower cost, easier installation, maintenance and higher reliability. They have found successfully industrial applications in automobiles, manufacturing plants, aircraft and unmanned vehicles. However, there are also challenging problems in NCSs, such as network-induced delays and packet dropouts [16-22], which are mainly caused by the limited bandwidth. Signal quantization is also a difficult issue, which has significant impact on the performance of the networked control [1-8]. There are also many results considering the quantization and delays or packet dropouts simultaneity, such as [14,15].

For NCSs with delays or packet dropouts, a class of NCSs with arbitrary but finite-length packet dropouts was described by [18]. [17] further extended this result to general arbitrary packet-dropout process and the Markovian bounded packet-dropout case. [22] is discussed H_2 control for NCSs with Markovian data losses and delays. For NCSs with quantization, [4] concerned with global asymptotic stabilization of continuous-time systems subject to the state quantization, the measured output quantization and the control input quantization, respectively. In [1], the quantized state feedback and quantized control input were considered for desecrate-time systems and the methods proposed could not