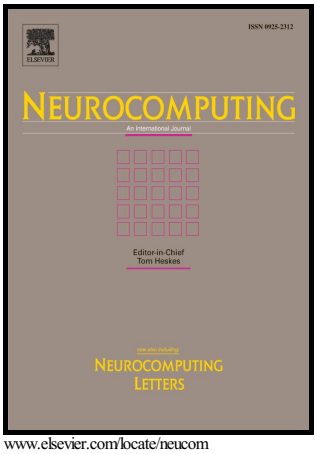


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# Networked Control System with Asynchronous Samplings and Quantizations in both Transmission and Receiving Channels

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**Abstract:** This study addresses a problem of the controlling networked control systems (NCSs) which is consisted of the continuous-time plant and controller. In both transmission and receiving channels, asynchronous sampling and different logarithmic quantization effect are considered. By categorizing three cases of asynchronous sampling and using two properties of quantizer which are sector bounded and convex combination, sufficient conditions of the existence of desired controllers for each asynchronous cases are presented in the form of linear matrix inequalities (LMIs). Simulation results are given to illustrate the validity of the proposed methods.

**Keywords:** Networked control system, Asynchronous sampling, Sampled-data, Quantization.



## 1 Introduction

During the past two decades, since the technologies for high-speed communication networks have been rapidly developed, the NCSs have widely studied and attracted much attention by many researchers [1]-[10]. The NCSs are the systems linked the components such as the controller, sensor, actuator through communication networks. The communication networks are used for sharing data such as control, reference, and plant output signals with components. The NCSs give rise to many advantages such as low cost, reduced weight, simple installation, easy maintenance, and flexible system structure. The great potential of the NCSs in applications has been found in wide-ranging research areas including factory automation, communication-based distributed mobile, unmanned vehicles, aircrafts, spacecrafts, and so on. As these appropriateness of the studying NCSs, various control schemes are employed to achieve control purposes [11]-[14]. In [11], an NCS with random delay was formulated as a kind of Markovian jump system, and then the output feedback networked-predictive-controller which compensates mixed random network-induced delays was designed for guaranteeing the stability of the system. In [12], the feasibility problem of fuzzy logic control method for an NCS was investigated based on implementation results of servo motor control using a Profibus-DP network and the system performance was compared with the conventional proportional-integral-derivative controllers. In [14], $\mathcal{H}_\infty$ predictive controller was designed for an NCS with data dropouts and time-varying delay in both forward and backward channels by using the switched Lyapunov function technique, in which the closed-loop system not only guarantees asymptotically stable, but also achieves desired control performance.

The quantization and sampling can be found in many real systems and many researchers have concentrated their effort to deal with it [15]-[23]. Especially, the NCSs have the higher possibility to occur the problems caused by quantizations and samplings than other systems. In practice, it is clear that the data exchange between components of the NCSs through networks arise by network devices (the transmitter and receiver). As well known, the network

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