

## PERFORMANCE GUIDED HYBRID LQ CONTROLLER FOR TIME-DELAY SYSTEMS

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**Abstract:** *In this paper the concept of multiple models and concept of switching controllers is used. The analog part of the system is described by finite set of discrete-time models. It is considered general case when time-delay of real process is not equal to integer multiple of sampling time. As a set of controllers is used a finite set of LQ controllers with the prescribed degree of stability. The switching rule is based on the selection of the best performance of the closed-loop system. In the form of theorem is proved that hybrid system is asymptotically stable in the Lypunov sense and performance of system is no worse then the best non-switching strategy.*

**Keywords:** *Multiple models, discrete-time LQ controller, hybrid control, asymptotic stability, optimality*

### 1. INTRODUCTION

Hybrid systems can be interpreted as digital real-time systems which are embedded in analog environments. Continuous (analog) variables take the values from the set of real numbers and the discrete variables take the values from a finite set of symbols. Analog part of the hybrid system is described with differential or difference equation [11] and discrete part of hybrid system is a event driven dynamics which can be described using concept from discrete event system such as timed automata, max-plus algebra or Petry nets [5]. For hybrid discrete systems whose components are dominantly discrete events analysis and design are based on tools from computer sciences [1].

From the clasical control theory point of view hybrid systems can be considered as a switching control between analog feedback loops. This area of research now is a very reech [23], [27].

Now we have a different approaches for control of hybrid dynamical systems. In the [3] mixed logical dynamical model for hybrid system is proposed. This model is described by linear dynamical equations subject to linear mixed-integer inequalites. The complementarity class of hybrid systems are systems with inequality constraints [13]. Concept of picewise linear system is introducet in [19]. Equivalence between above classes of hybrid systems is established in [14].













