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EXPRESSIVE POWER OF HYBRID SYSTEMS WITH REAL VARIABLES, INTEGER VARIABLES AND ARRAYS[1]

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ABSTRACT

Hybrid systems is a suitable model to describe systems composed of both continuous and discrete components. The continuous components typically represent physic events. The discrete components are logic devices, such as switches and digital circuitry. A typical example is a system where physical processes are controlled by embedded controllers. Different classes of hybrid systems have been proposed. In this paper we consider hybrid systems equipped with real variable (as usual), integer variables and unbounded arrays. We study the expressive power of five classes: Linear real hybrid systems, Polynomial real hybrid systems, Mixed hybrid systems, D-hybrid systems and S-Hybrid systems. For these classes there exists a quantifier elimination technique for computing the successor operator, hence the reachability problem is semidecidable.

Keywords: Hybrid Systems, Arrays, Integer Variables, Real Variables, Expressiveness

1. Introduction

Often the systems one wants to model are control systems embedded in an environment from which stimuli may arrive with different laws. As an example, sensors controlling temperature or water level may have a non-linear evolution law. *Hybrid Systems* have been introduced to describe similar situations (see [1] and [4]). A hybrid system consists of a finite number of locations, variables and transitions. In each location variables change their value as a function of the time elapsed, and satisfy, at each instant, a formula called the invariant. The system can take a transition to evolve from a location to another location. The transition is labeled with a formula that gives the values of variables triggering the transition and their new values after the transition has been performed. Different variants of this model have been considered. Classes are usually distinguished by the mathematical logic used.

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