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## ON CONCISENESS OF EXTENSIONS OF TIMED AUTOMATA

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## ABSTRACT

In this paper we study conciseness of various extensions of timed automata, and prove that several features like diagonal constraints or updates lead to exponentially more concise timed models.

Keywords: Timed automata, conciseness, diagonal constraints, updates

## 1. Introduction

Model-checking of real-time systems. Since their introduction by Alur and Dill in the beginning of the 90's [2, 3], timed automata are a widely used and studied model for real-time systems. Since that time, numerous works have been devoted to the theoretical comprehension of this model. The success of this model is mostly due to the decidability of reachability properties [3] and to its use in verification, and more specifically in model-checking [1]. It is worth to notice that based on these decidability properties, several tools analyzing timed automata have been developed [9, 14] and successfully used.

Modelling real-time systems. With the motivation to easily model numerous real systems, many extensions of timed automata have been proposed and studied, among others extensions of clock constraints [5, 8], extensions of operations on clocks [6], use of silent actions [4], variation of the slopes of clocks [12, 10, 7]. For such extensions, several points are of interest: a) the decidability of reachability properties (to use this model for verification purposes), b) the expressive power (to model a large class of systems), and c) the conciseness of induced models. The first two points are classical when studying models for verification purposes: it is fundamental to have models which can be analyzed and which can represent many real systems (indeed models used for verification have to be the result of a compromise between expressiveness and decidability). Point c) is discussed below.