A Simplified Approach for Testing Real-Time Systems Based on Action Refinement

Saddek Bensalem*, Moez Krichen*,
Lotfi Majdoub**, Riadh Robbana**,
Stavros Tripakis***

* Verimag Laboratory, Centre Equation 2, avenue de Vignate, 38610, Gières, France.
saddek.bensalem@imag.fr, moez.krichen@imag.fr.
** LIP2 Laboratory and Polytechnic School of Tunisia.
lotfi.majdoub@ensi.rnu.tn, riadh.robbana@fst.rnu.tn.
*** Verimag Laboratory and Cadence Berkeley Labs, 1995 University avenue,
Suite 460, Berkeley, CA 94704, USA.
tripakis@cadence.com.

Abstract. We propose a new method for generating digital-clock tests for real-time systems. That is, tests which can observe time with only a finite precision. Our goal from testing is to check the conformance of a given implementation with respect to a given specification (the model). The method is based on the so-called action refinement techniques. The main benefit of the method is to save memory space needed to build and to store tests. One important contribution of this work is a simplified way for both modelling and testing real-time systems. We first write a (high-level) simplified version of the model of the system, as an input-output transition system (IOTS) and then we refine it into a more detailed (low-level) model as a timed input-output transition system (TIOTS). This same mechanism applies to the test generation procedure.

1 Introduction

Action refinement techniques are well experimented techniques in the field of hierarchical design of wide classes of systems. They mainly consist in translating high-level actions into lower-level ones. That is to move from a high-level abstraction to a lower one until reaching the implementation level.

Applying action refinement techniques in the field of testing is quite promising. Current techniques typically suffer from state explosion problems: this includes test generation, storage and execution. The problem is more dramatic in the case of timed systems, where an extra level of complexity is introduced by handling time-measuring variables (clocks).

Our main goal in this paper is to reduce the size of generated tests. Our focus is on digital-clock test generation for real-time systems (Krichen and Tripakis, 2004, 2005) and our objective is to improve our previous method to generate such tests. To achieve this, we use an approach based on action refinement. In our timed setting, untimed actions are refined into timed actions. This helps reduce redundancy and results in optimized storage of useful data.