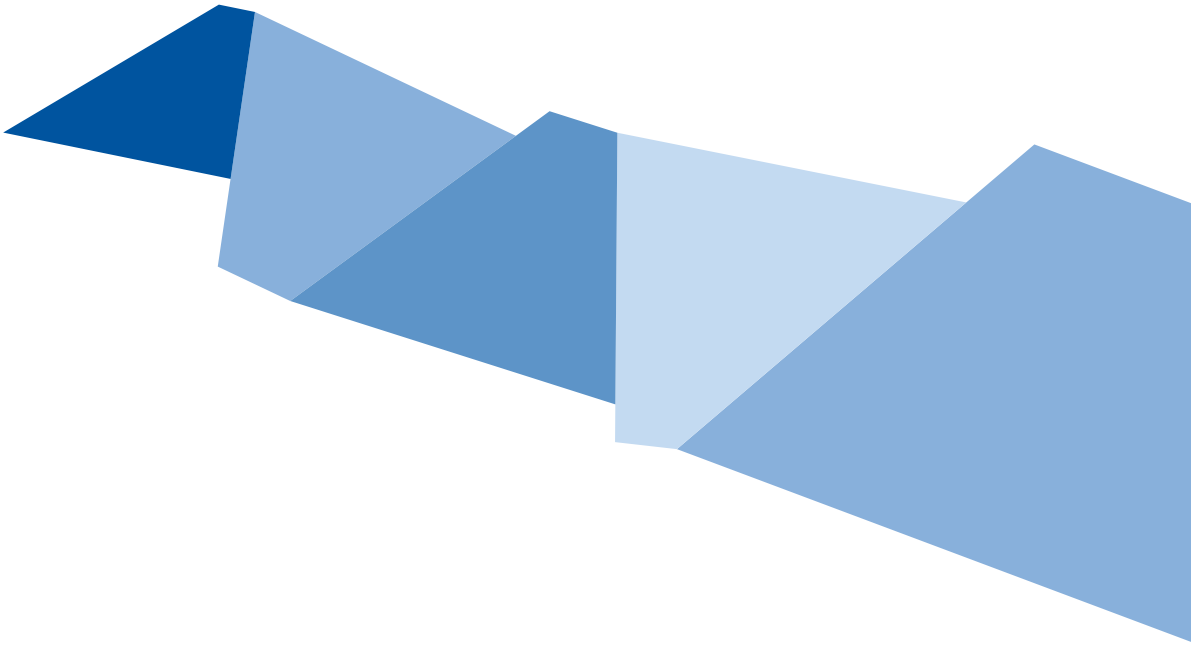

Deciding LTL over Mazukiewicz Traces

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Deciding LTL over Mazurkiewicz Traces

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Abstract. Linear time temporal logic (LTL) has become a well established tool for specifying the dynamic behaviour of reactive systems with an interleaving semantics, and the automata-theoretic approach has proven to be a very useful mechanism for performing automatic verification in this setting. Especially alternating automata turned out to be a powerful tool in constructing efficient yet simple to understand decision procedures and directly yield further *on–the–fly* model checking procedures. In this paper we exhibit a decision procedure for LTL over Mazurkiewicz traces which generalises the classical automata-theoretic approach to a linear time temporal logic interpreted no longer over sequences but certain partial orders. Specifically, we construct a (linear) alternating Büchi automaton accepting the set of linearisations of traces satisfying the formula at hand. The salient point of our technique is to apply a notion of independence-rewriting to formulas of the logic. Furthermore, we show that the class of *linear* and *trace-consistent* alternating Büchi automata corresponds exactly to LTL formulas over Mazurkiewicz traces, lifting a similar result from Löding and Thomas formulated in the framework of LTL over words.

1 Introduction

Linear time Temporal Logic (LTL) as proposed by Pnueli [Pnu77] has become a well established tool for specifying the dynamic behaviour of distributed systems. The traditional approach towards automatic program verification is model checking specifications in LTL. A basic feature of LTL has been that its formulas are interpreted over sequences. Typically, such a sequence will model a computation of a system; a sequence of states visited by the system or a sequence of actions executed by the system during the course of the computation.

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