Closure under stuttering in temporal formulas

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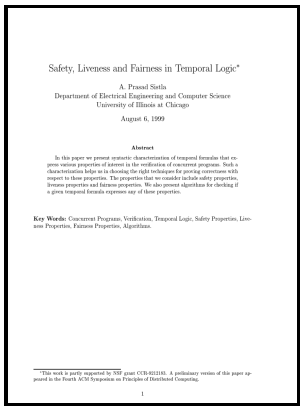

Safety, Liveness and Fairness in Temporal Logic*

A. Prasad Sistla
Department of Electrical Engineering and Computer Science
University of Illinois at Chicago

August 6, 1999

Abstract

In this paper we present syntactic characterization of temporal formulas that express various properties of interest in the verification of concurrent programs. Such a characterization helps us in choosing the right techniques for proving correctness with respect to those properties. The properties that we consider include safety properties, liveness properties and fairness properties. We also present algorithms for checking if a given temporal formula expresses any of these properties.

Key Words: Concurrent Programs, Verification, Temporal Logic, Safety Properties, Liveness Properties, Fairness Properties, Algorithms.

*This work is partly supported by NSF grant CCR-9321141. A preliminary version of this paper appeared in the Fourth ACM Symposium on Principles of Distributed Computing.

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Description: -
-Closure under stuttering in temporal formulas
-
Canadian theses = -- Thèses canadiennesClosure under stuttering in temporal formulas
Notes: Thesis (M.Sc.) -- University of Toronto, 1999.
This edition was published in 1999

Filesize: 51.11 MB

Tags: #Events #in #Property #Patterns

On Closure Under Stuttering

The core of our approach is a heuristic algorithm for detecting and extending SI components of Büchi automata BA during the translation from LTL formulae into BAs. Indeed, the knowledge that the specification does not distinguish between equivalent execution sequences allows constructing a reduced state space where it is sufficient that at least one sequence per equivalence class is represented. Hence, checking the closure of a specification is no more difficult than checking satisfiability of a temporal formula.

An algorithmic approach for checking closure properties of temporal logic specifications and ω

Conventional POR only support checking formulae without the next-time operator because these formulae are invariant under stuttering, thus are suitable for POR.

An algorithmic approach for checking closure properties of temporal logic specifications and ω

More precisely, it supports the full class of LTL formulae with the next-time operator.

Events in Property Patterns

Lecture Notes in Computer Science, vol 9232. In this paper, we introduce a notion of edges of LTL formulas and present a formal theory of closure under stuttering. For over a decade, researchers in formal methods have tried to create formalisms that permit natural specification of systems and allow mathematical reasoning about their correctness.

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Considering these sequences as different is semantically rather meaningless. Further, determining whether a given LTL property is closed under stuttering is PSPACE-complete. In concurrency theory, there are several examples where the interleaved model of concurrency can distinguish between execution sequences which are not significantly different.

On translations of temporal logic of actions into monadic second

The refined temporal language we propose is closed under w-stuttering and, thus, provides a fully abstract semantics with respect to some chosen observation level w.

An algorithmic approach for checking closure properties of temporal logic specifications and ω

Finally, we apply the theory to the pattern-based approach of specifying temporal formulas. Edges allow natural modelling of systems with events.

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