

Verification of linear duration invariants by model checking CTL properties

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Abstract: Linear duration invariants (LDI) are important safety properties of real-time systems. They can be easily formulated in terms of a class of chop-free formulas in the Duration Calculus (DC). Compared to other temporal logics, the specification in DC is simpler, neater and more importantly easier to understand. However, directly model checking them is more difficult than model checking properties formulated in the computation tree logic (CTL). In this paper, we present a technique for the verification of the satisfaction of a LDI by a timed automaton by model checking a CTL property. For this, we construct an untimed automaton G from A , and prove that A satisfies φ iff G is satisfied by the set of all paths of G . To verify that all paths of G satisfy ψ , we construct a CTL formula ψ and simply check if G satisfies ψ . By this, we convert the problem of verification of the LDI to the problem of model checking CTL formula. As a result, the CTL model checking techniques and tools, such as UPPAAL, can be used for verification of LDI specified in the DC. © Springer-Verlag Berlin Heidelberg 2008.

Index Keywords: Automata theory; Error analysis; Real time systems; Translation (languages); Computation tree logic; CTL model checking; Directly model; Duration calculus; Linear duration; Safety properties; Timed automaton; Model checking

Year: 2008

Source title: Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)

Volume: 5160 LNCS

Page : 395-409

Link: [Scopus Link](#)

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Conference name: 5th International Colloquium on Theoretical Aspects of Computing, ICTAC 2008

Conference date: 1 September 2008 through 3 September 2008

Conference location: Istanbul

Conference code: 73634

ISSN: 3029743

ISBN: 3540857613; 9783540857617

DOI: 10.1007/978-3-540-85762-4_27

Language of Original Document: English

Abbreviated Source Title: Lecture Notes in Computer Science (including subseries Lecture Notes in

- Zhang, M., School of Software Engineering, Tongji University, Shanghai, China
- Van Hung, D., College of Technology, Vietnam National University, Hanoi, Viet Nam
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