– Erratum –

Temporal Logic with Past is Exponentially More Succinct

Nicolas Markey

June 3, 2020

In [Mar03b, end of Section 1] and [Mar03a, Section 1.2.2.2], the informal proof of the claim that PLTL can be translated into LTL over infinite words with a triply-exponential blowup is wrong: the translation given in [MP90, MP94] does not return pure-future LTL formulas, but Boolean combinations of formulas of the form $\mathbf{G}\,\mathbf{F}\,\phi$, where $\phi \in \mathsf{PLTL}$.

To the best of my knowledge as of June 3, 2020, no progresses have been made on the translation of PLTL to LTL over infinite words since the (non-elementary) translations of [Gab89] and [MMKR94].

Notice that a (doubly-exponential) transformation from deterministic counter-free finite-state automata into LTL exists over *finite* words [Wil99]. A translation from PLTL to LTL over finite words follows (with a 4-exponential blowup).

References

[Gab89] Dov M. Gabbay. The declarative past and imperative future: Executable temporal logic for interactive systems. In Behnam Banieqbal, Howard Barringer, and Amir Pnueli, editors, *Proceedings of the 1st Conference on Temporal Logic in Specification*, volume 398 of *Lecture Notes in Computer Science*, pages 409–448. Springer-Verlag, 1989.

[Mar03a] Nicolas Markey. *Logiques temporelles pour la vérification : expressivité, complexité, algorithmes*. Thèse de doctorat, Lab. Informatique Fondamentale d'Orléans, France, April 2003.

[Mar03b] Nicolas Markey. Temporal logic with past is exponentially more succinct. *EATCS Bulletin*, 79:122–128, February 2003.

[MMKR94] Louise E. Moser, P. Michael Melliar-Smith, George Kutty, and Y. Srinivas Ramakrishna. Completeness and soundness of axiomatizations for temporal logics without next. *Fundamenta Informaticae*, 21(4):257–305, October 1994.

[MP90] Oded Maler and Amir Pnueli. Tight bounds on the complexity of cascaded decomposition of automata. In *Proceedings of the 31st Annual Symposium on Foundations of Computer Science (FOCS'90)*, pages 672–682. IEEE Comp. Soc. Press, October 1990.

[MP94] Oded Maler and Amir Pnueli. On the cascaded decomposition of automata, its complexity and its application to logic. 1994.

[Wil99] Thomas Wilke. Classifying discrete temporal properties. In Christoph Meinel and Sophie Tison, editors, *Proceedings of the 16th Symposium on Theoretical Aspects of Computer Science (STACS'99)*, volume 1563 of *Lecture Notes in Computer Science*, pages 32–46. Springer-Verlag, March 1999.