DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
UNIVERSITY OF SOUTHERN DENMARK, ODENSE

COMPUTER SCIENCE COLLOQUIUM

A uniform framework for timed automata

Tomasz Brengos
Faculty of Mathematics and Information Science
Warsaw University of Technology, Poland

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Abstract:

Timed automata, and machines alike, currently lack a general mathematical characterisation. We introduce a uniform coalgebraic understanding of these devices. This framework encompasses known behavioural equivalences for timed automata and paves the way for the extension of these notions to new timed behaviours and for the instantiation of established results from the coalgebraic theory as well. Lax functors are the cornerstone of the framework: they allow us to model time flow as a context property and hence offer a general and expressive setting where to study timed systems. In this setting the index category encodes "how step sequences form executions" (e.g. whether steps duration is accumulated or kept distinct) whereas the base category encodes "step nature and composition" (e.g. non-determinism and labels). Finally, we develop the notion of general saturation for lax functors and show how equivalences of interest for timed behaviours are instances of this notion. This characterisation allows us to reason about the expressiveness of said notions within a uniform framework and organise them in a spectrum independent from the behavioural aspects encoded in the base category.

Host: Marco Peressotti