Content

Introduction

• First-order Logic
• Duration Calculus (DC)
  • Semantical Correctness
    • Proof with DC
  • DC Decidability
  • DC Implementables
  • DC Proof Systems
  • PLC-Automata
• Timed Automata (TA), Uppaal
• Networks of Timed Automata
  • Region/Zone-Abstraction
  • Extended Timed Automata
• Undecidability Results

obs: Time \rightarrow BW (obs)
⟨ obs_0, ν_0 ⟩, t_0 \overset{λ_0}{\rightarrow} ⟨ obs_1, ν_1 ⟩, t_1.

Recap

– 19 – 2013 -07-16 – Srecap –

Lectures

• Lecture01: Introduction
• Lecture02: Timed Behaviour
• Lecture03: Duration Calculus I (Symbols, State Assertions)
• Lecture04: Duration Calculus II (Terms, Formulae)
• Lecture05: Duration Calculus III (Abbreviations, Satisfy/Realise)
• Lecture06: DC Properties I (RDC in Discrete Time)
• Lecture07: DC Properties II (RDC in Continuous Time)
• Lecture08: DC Implementables
• Lecture09: PLC-Automata
• Lecture10: Timed Automata
• Lecture11: Networks of Timed Automata
• Lecture12: Location Reachability (or: The Region Automaton)
• Lecture13: Zones
• Lecture14: Extended Timed Automata
• Lecture15: Timed Büchi Automata
• Lecture16: The Universality Problem for TBA
• Lecture17: Automatic Verification of DC Properties for TAI
• Lecture18: Automatic Verification of DC Properties for TAI

Motivation/Big Picture

Lecture 1:
• What is a real-time system?
• In contrast to reactive, hybrid, ...?
• What is a safety-critical system?
• When do we call a real-time system correct?
• What is an approach to the development of correct real-time systems? What prerequisites does it have?
• What could justify this high effort?
• What are hard/soft deadlines?
• How did we partition reactive systems?
• Can you give an example for a "plant" from the tutorials.
• What's discrete and what's continuous time? Which did we use and why?
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• Lecture17: AutomaticVerificationofDCPropertiesforTAI
• Lecture18: AutomaticVerificationofDCPropertiesforTAII
Lecture 18: Automatic Verification of DC Properties for TAI

Can you give a network of TAI which has correspondence in the formal semantics?

Where has the notion of “input action” and “output action” a location of this?

Is there something remarkable about the definition of configurations?

What's a configuration of a TAI? When are two in transition relation?

What's the issue with the cycle time in a PLCA?

What is a PLCA automaton?

What would distinguish a real-time from a plain Linux anyway?

What is a control automaton?

What is a controller that satisfies a given requirement.

What if we don't have a PLC at hand but only a real-time Linux and a C compiler?

What is a basic phase of a control automaton?

What is the “philosophy” of PLC? What did we generalise/abstract them to?

What are the requirements for following tasks/questions.

Can you imagine what somebody means by saying “TAs are closed under parallel composition”?

Canyou give an example of an implementation with DC?
Lecture 12:

Educational Objectives:
- Capabilities for following tasks/questions.
- What are decidable problems of TA?
- How can we show this? What are the essential premises of decidability?
- What is a region? What is the region automaton of this TA?
- What's the time abstract system of a TA? Why did we consider this?
- What can you say about the complexity of Region-automaton based reachability analysis?

Lecture 13:

Educational Objectives:
- Capabilities for following tasks/questions.
- What's a zone? In contrast to a region?
- Motivation for having zones?
- What's a DBM? Why do we need to know DBMs?

Lecture 15:

Educational Objectives:
- Capabilities for following tasks/questions.
- What's a TBA and what's the difference to (extended) TA?
- What is a timed (regular) language?
- What language does this TBA accept?
- Can you give a TBA with this language?
- What's undecidable for timed (Büchi) automata?
- Why is this unfortunate?
- What's the idea of the proof?
- What's the universality problem?
References