CPS: Breakthrough: Compositional Modeling of Cyber-Physical Systems

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Description

Goal
Theory of composition for cyber-physical systems

Motivation
• Model re-use
• System analysis via subsystems
• Cross-cutting principles

Challenge
Uniform model for continuous, discrete dynamics

Approach  Algebra!
• Systems as mathematical objects
• Composition via functions
Findings

- Generalized synchronization trees (GSTs) as CPS model
  - Uniformly encodes discrete, continuous behavior
  - Conservatively extends existing models of discrete systems
- Encoding of existing models in GSTs
- Notions of semantic equivalence based on bisimulation that uniformly extends existing discrete notions
- Logical characterizations of bisimulation