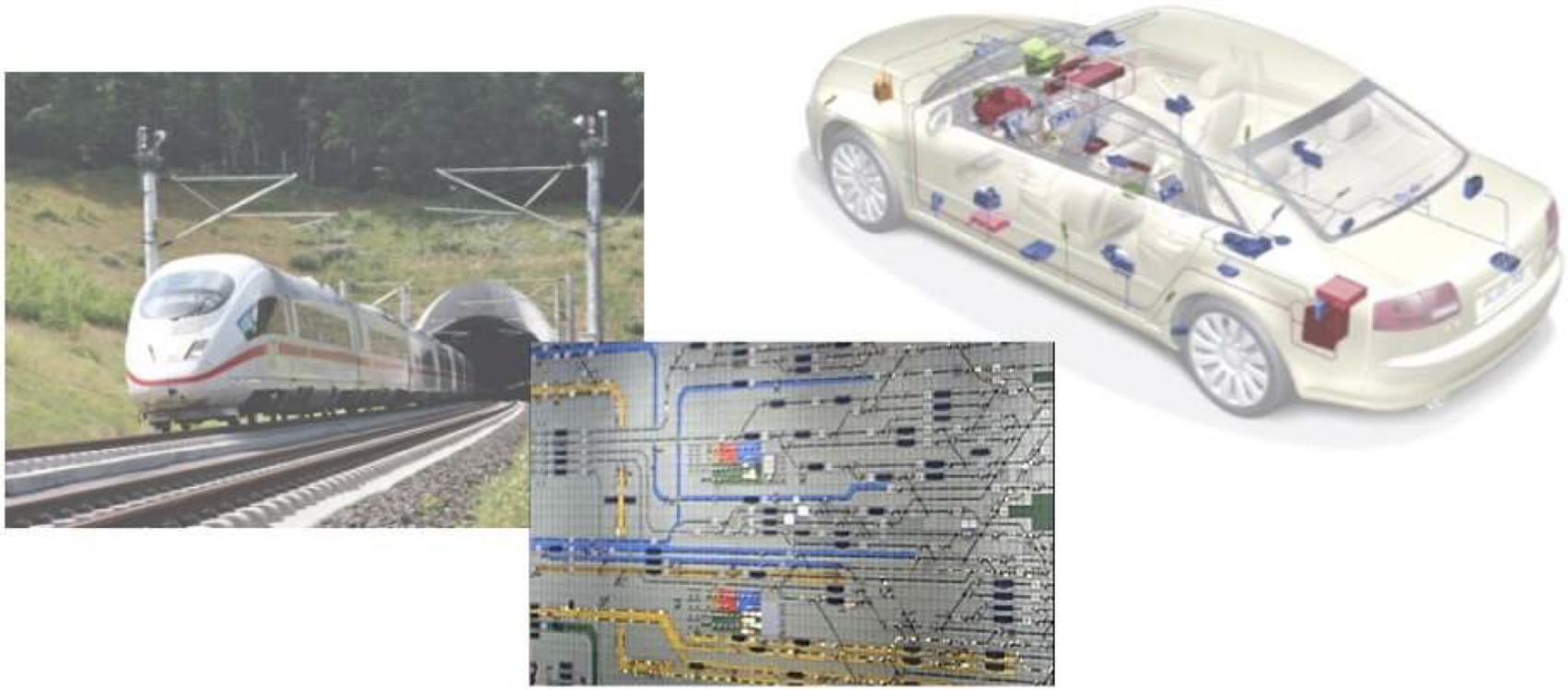
Model Checking and Systems Verification (MCSV)

Instructor; M.K. Srivas
TA: Zubin Duggal

August 11, 2020

Embedded Systems



- Embedded (HW+SW+FW) systems are a complex parts of real life machines

Model Checking: Motivation

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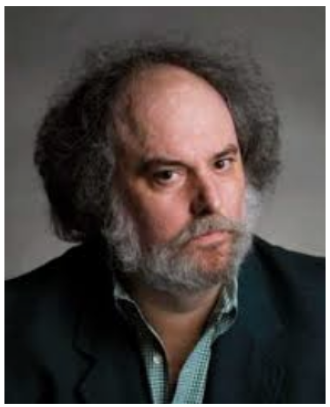
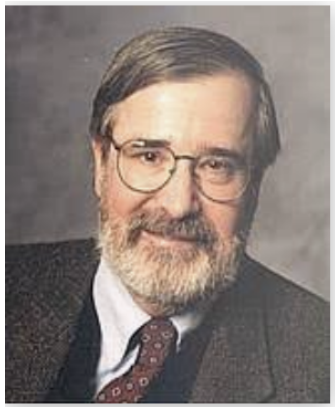
- Can we have methods that guarantee 100% coverage
  - Formal Verification: Methods based on Logic and Automata theory
  - Model Checking is one such popular techinique

Model Checking: Cited for Turing Award in 2007 (Invented: 1986)



ACM Turing Award Hon...
cs.utexas.edu

E. Allen Emerson



Introduction to Model C...
moves.rwth-aachen.de

Edmund Clarke

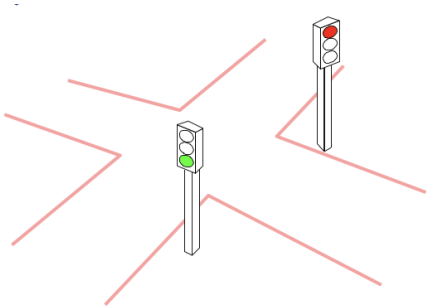
Joseph Sifakis | French com...
britannica.com

Joseph Sifakis

CITATION

Together with E. Allen Emerson and Joseph Sifakis, for their role in developing Model-Checking into a highly effective verification technology that is widely adopted in the hardware and software industries.

What Kind of Systems and Properties?



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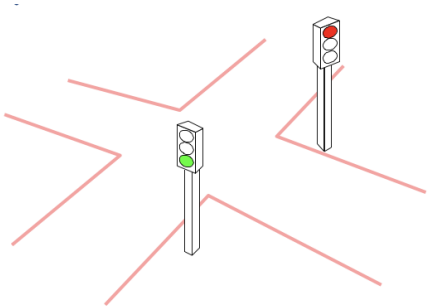

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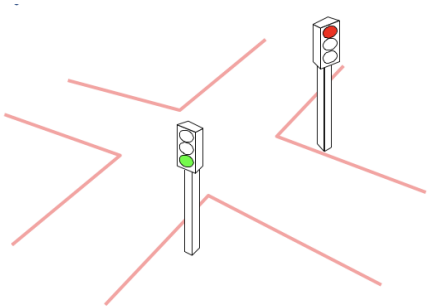

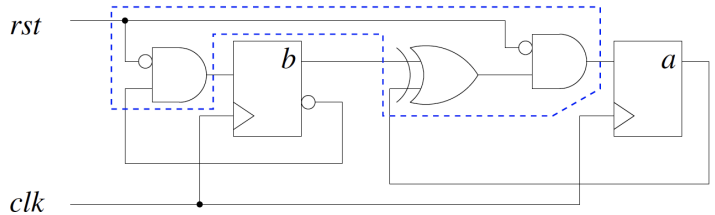

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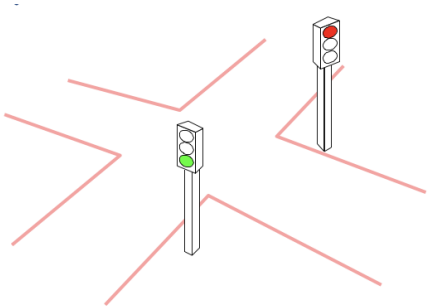

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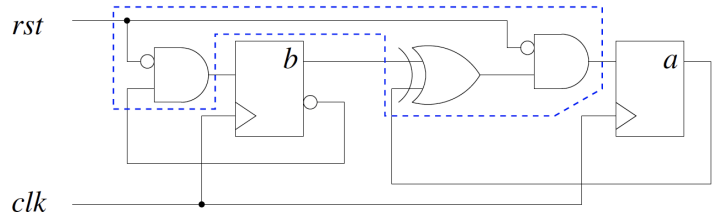

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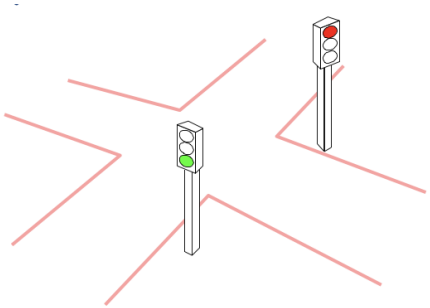

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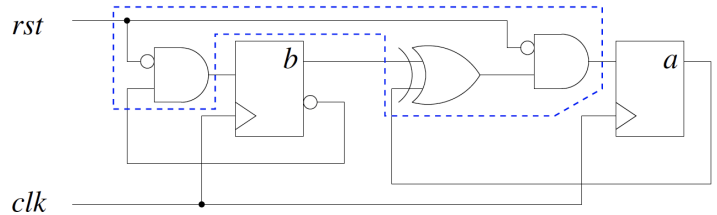

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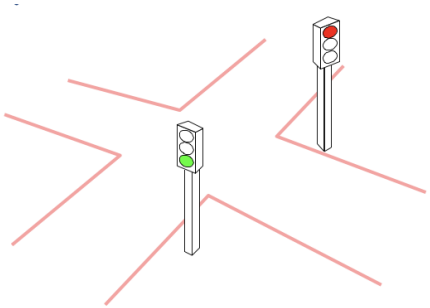

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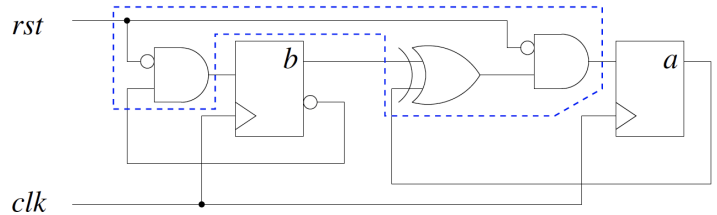

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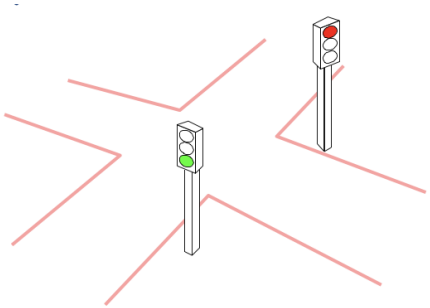

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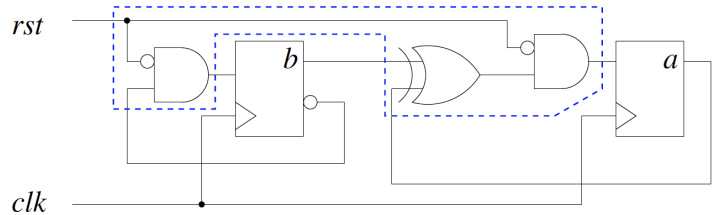

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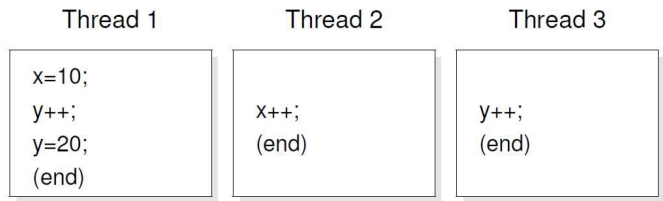

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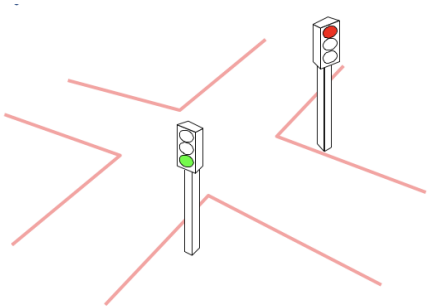

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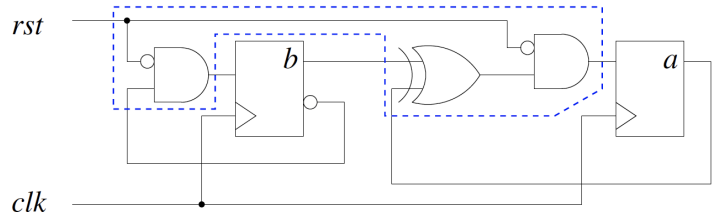

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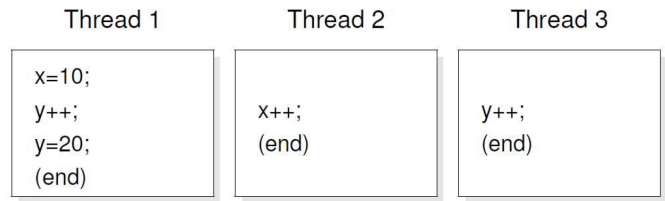
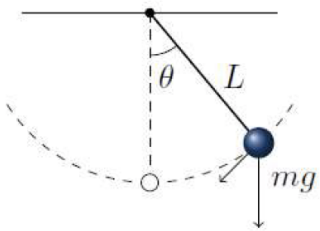
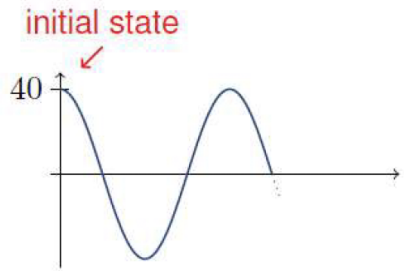


"the program has no data races"

What Kind of Systems Not

An Example





Our model:

$$\frac{\delta^2\theta}{\delta t^2} = -\frac{g}{L}\sin\theta$$

Plot of θ over time

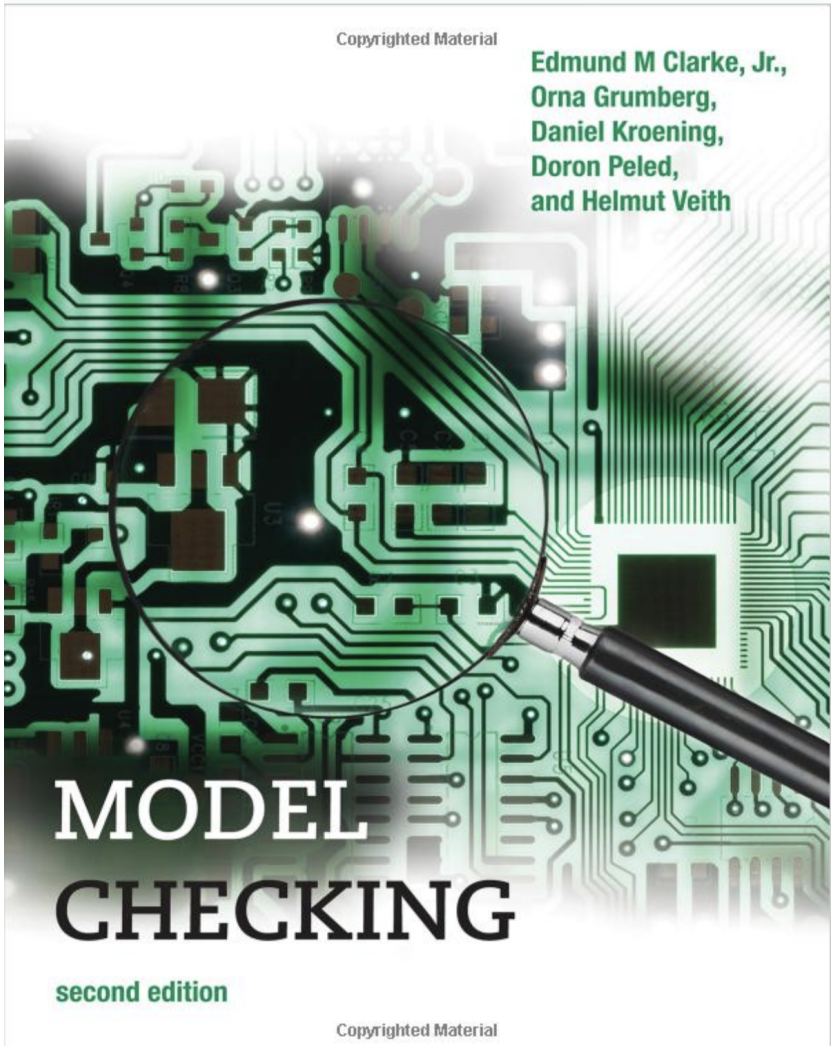
Brief Course Outline

1. Modeling Systems (Kripke Structures)
2. Specifying Properties (Temporal logics: CTL, LTL, CTL*)
3. Verifying Properties (Model Checking for Temporal logics)
4. Abstraction Techniques
5. Automata-Based Model Checking

Course Work and Grade Distribution

1. Written Assignments: 30%
2. Tool Exercises: 30%
3. 2 Quizzes: 40%
   - One can be a small programming project

Reference Text Book



eTextBook will be made available for class usage on shared (sign-up sheet) basis

Access details will be shared on Moodle

Some Definitions

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  - why should such a K exist at all?