28: Extended state machines + Hybrid systems

Formalizing FSMs

We handwaved some aspects of FSMs

- ✓ Role and behavior of inputs and outputs
- ✓ Presence/absence of self-loops

Distinction between FSMs and extended SMs

Keeping track of data

An FSM is a 5-tuple: (States, Inputs, Outputs, update, initialState)

How do we keep track of internal data?

Example: system with yes/no vote buttons, keep track of difference in votes (board example)









Figure 3.3: Visual notation for a finite state machine.



Figure 3.9: Notation for extended state machines.

Lee/Seshia chapter 3



What are we missing out on when we tell time by using "mils" as an input?



Discrete System (FSM)



Continuous System



Slide from Prabal Dutta and Sanjal A. Seshia, 2019

Timed automata

Distinction between discrete and continuous variables

Continuous behavior defined in "states"

Now called "modes"



Figure 4.4: Notation for hybrid systems.

ODEs

Sometimes it is more desirable to describe a variable in terms of how it changes rather than its explicit form

Useful for: modeling, reasoning

Define a function in terms of its derivative and possibly initial conditions

Ordinary Differential Equation, or ODE

Solving general ODEs is beyond the scope of the class, but we will discuss some patterns here

Discussion of homework problems

Example: bouncing ball

Board discussion

