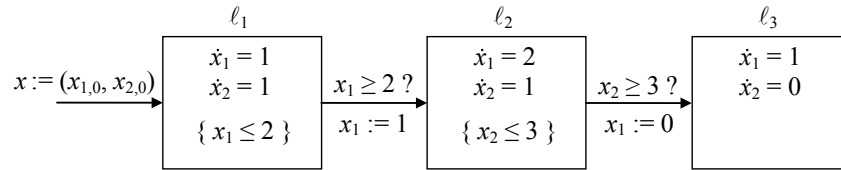


Analysis and Control of Cyber-Physical Systems

Homework 4 — 28 April 2022

Problem 1. Consider the hybrid automaton H whose graphical representation is shown below.



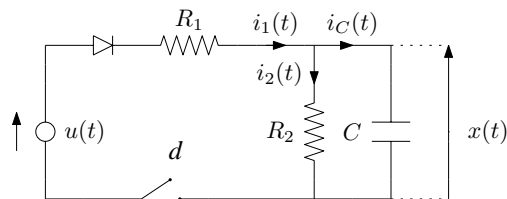
- Describe the algebraic structure of H .
- Write an OpenModelica program to model H and simulate its evolution from the two different initial conditions

$$x'_0 = (1, 0) \quad \text{and} \quad x''_0 = (0, 1).$$

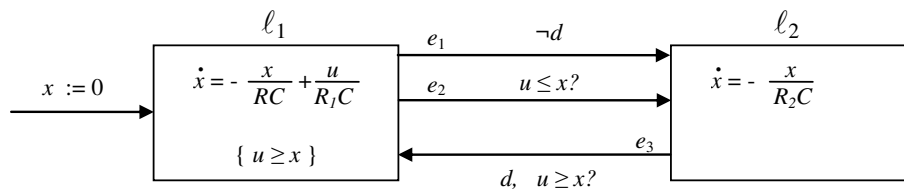
For each simulation shown $x_1(t)$, $x_2(t)$ and $\ell(t)$.

- Describe as hybrid signals the two evolutions previously computed.

Problem 2. Consider the circuit with a diode studied in the Example 10.7 of the class notes, which is shown in the figure below.



The hybrid automaton model of this device is shown in the next figure.



- Write an OpenModelica program to model this automaton.

The following values are suggested: $R_1 = 500 \Omega$, $R_2 = 700 \Omega$, $C = 0.01 F$.

- Simulate its evolution for $t \in [0, 40]$ assuming that $u(t) = \sin(t)$ and that the switch is opened for $t \in [20, 30]$ and closed otherwise.