Congratulations! You passed!
TO PASS 80% or higher

Keep Learning

GRADE
100%

Quiz 5

LATEST SUBMISSION GRADE
100%

1. Which of the following statements is false? **1 / 1 point**

- ○ Hybrid automata consist of modes, guards, transitions, and resets.
- ○ Even though the individual modes are stable, the composite hybrid system need not be stable.
- ○ Certain types of Zeno behaviors can be removed by introducing a new mode.
- ○ The Zeno phenomenon should be addressed when designing hybrid control systems.
- ◉ Existential stability implies universal stability.

Correct
This question tests several of the concepts introduced in lecture this week.

2. Consider the switched system **1 / 1 point**

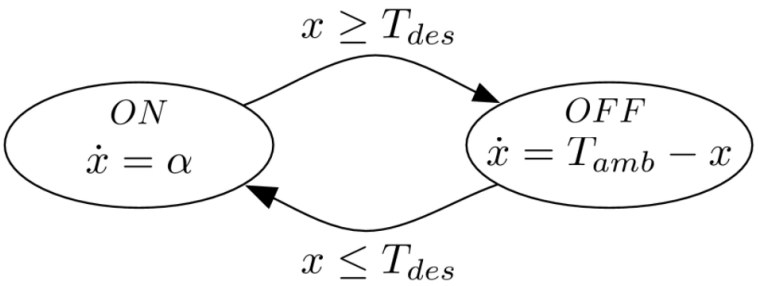
$$\dot{x} = \begin{cases} x & \text{if } x \leq 1 \\ -2x & \text{if } x > 1. \end{cases}$$

This system is Type 1 Zeno. What is the induced mode?

- ○ $\dot{x} = 1$
- ○ $\dot{x} = -x$
- ○ $\dot{x} = x$
- ○ $\dot{x} = -1$
- ◉ $\dot{x} = 0$

Correct
Draw the regularized hybrid automata that corresponds with this system and compute the dynamics for the induced mode.

3. Below is shown a model of a thermostat in a building. In the model, x is the temperature and in the ON-mode, the thermostat is increasing the temperature at a rate of $\alpha > 0$, while in the OFF-mode, the thermostat is simply off. What this means is that the temperature will exponentially decay down to the ambient temperature T_{amb}. Moreover, the desired temperature in the thermostat is set to T_{des}, where we assume that $T_{des} > T_{amb}$. **1 / 1 point**



Why is the hybrid automaton a bad thermostat?

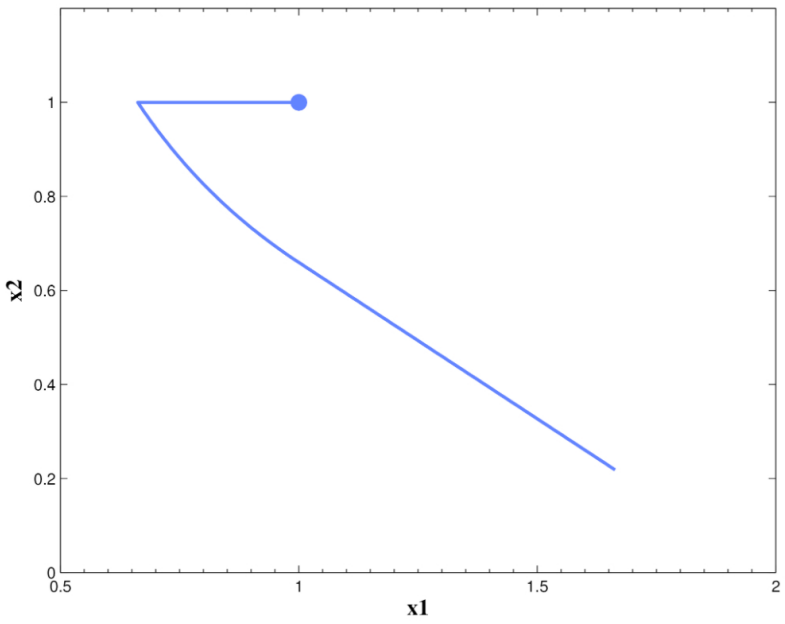
- ○ It is a Type 2 Zeno system.
- ◉ Once $x = T_{des}$ it will switch infinitely fast between the two modes.
- ○ Once $x = T_{amb}$ it will switch infinitely fast between the two modes.
- ○ There is nothing wrong with the hybrid automaton.

It will never reach the desired temperature T_{des}.

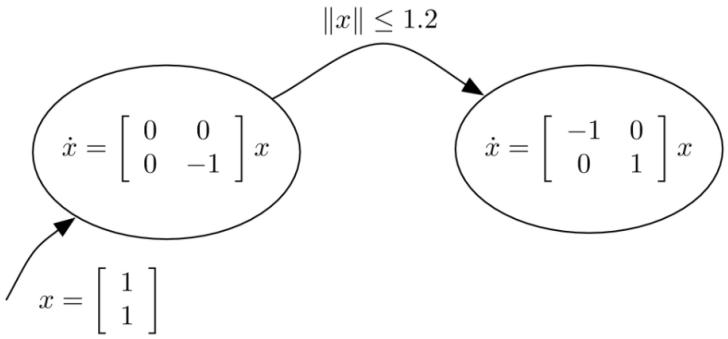
✓ **Correct**

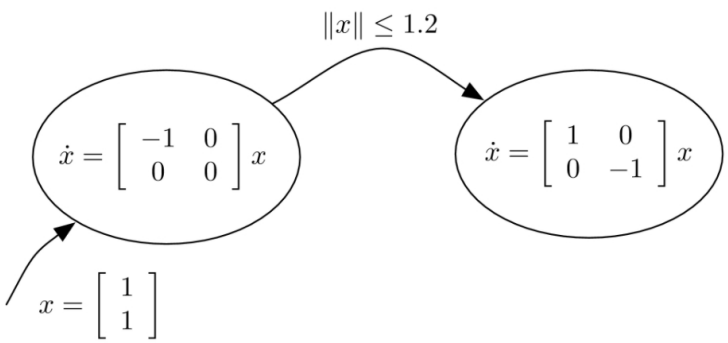
Think through the behavior of this automaton to answer the question.

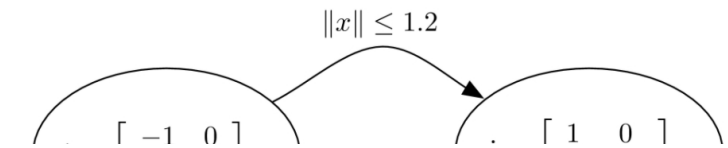
4. Consider the plot shown below, where the initial condition is $(x_1, x_2) = (1, 1)$ is marked by a solid circle. **1 / 1 point**

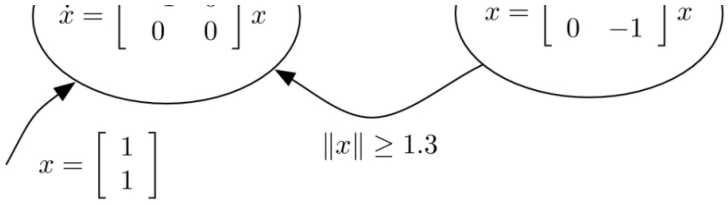


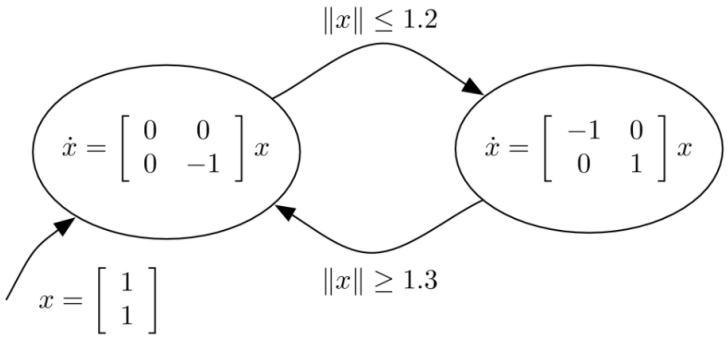
Which Hybrid Automaton was used to generate this plot?

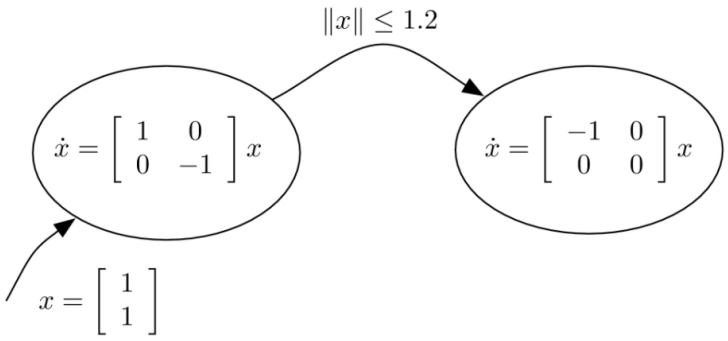












Correct
Try to think about the switching condition and dynamics in each state separately. It may also be helpful to write out the equations for $\dot{x}$ (taking it out of matrix form).

5. Why do we care about hybrid systems when designing robotic controllers? **1 / 1 point**

- The environment is unknown and we cannot design a single controller that deals with all possible environmental conditions the robot may encounter.
- It connects to how biological systems, e.g., animals, are thought to behave.
- It makes the design task modular in that new functionality can be added onto already existing control structures.
- They all are valid concerns.
- It makes the design easier in that the design task is broken down into building blocks.

Correct
This question requires you to think back to all the discussions we've had about robotics in this course.