Control of Mobile Robots: Glue Lectures

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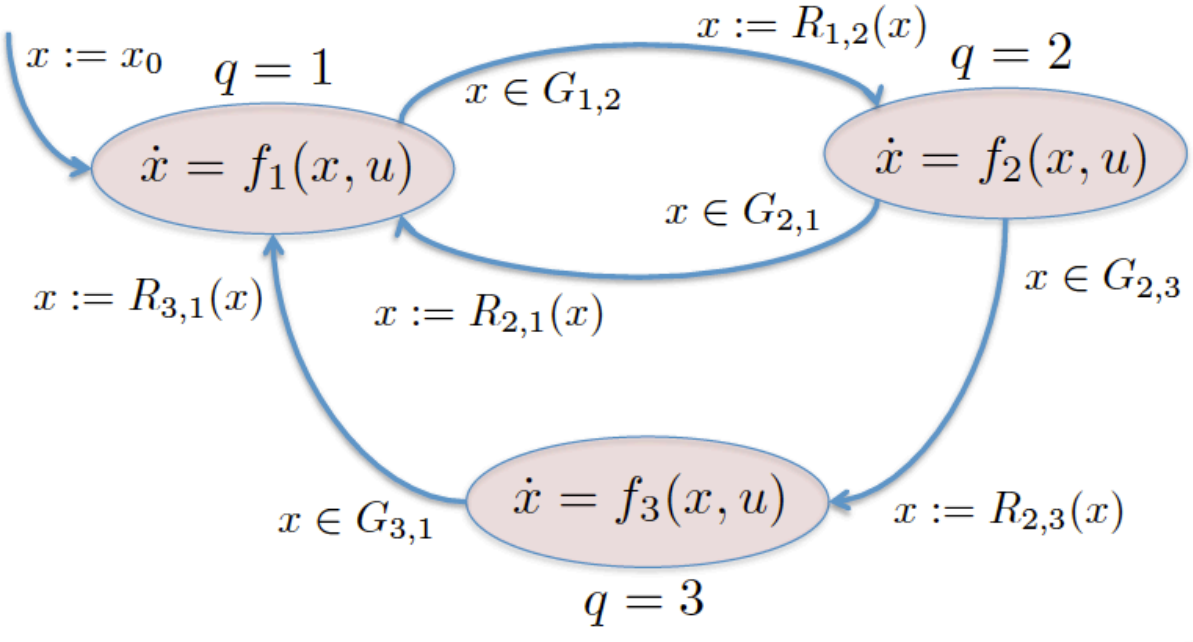
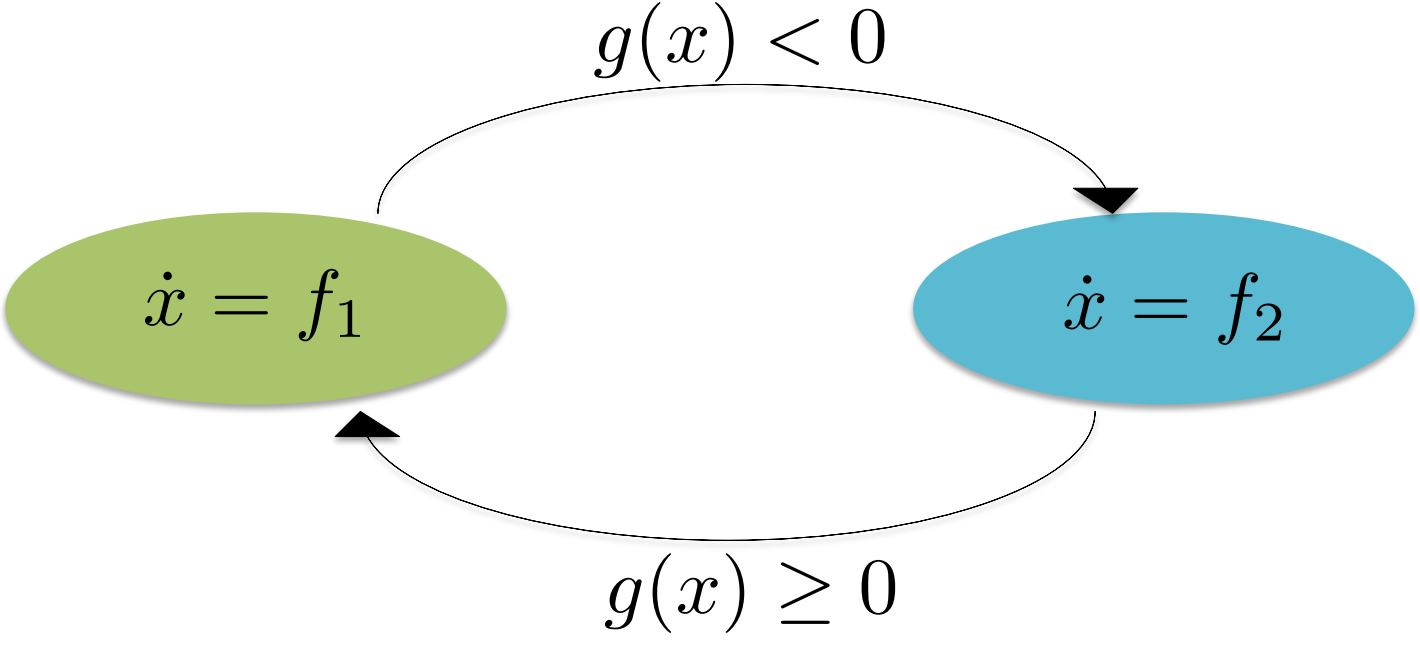
Glue Lecture 5: Hybrid Automata

Pay attention, this lecture will help you all with Quiz 5!

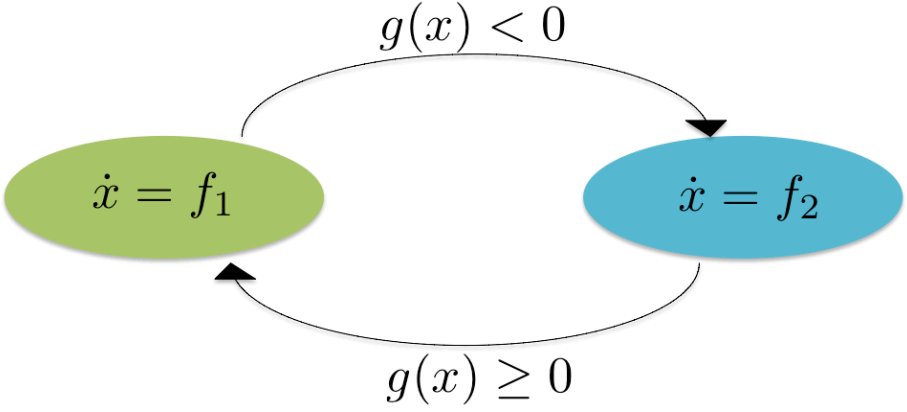
For example,


$x := x_0$
$q = 1$
$\dot{x} = f_1(x, u)$
$x := R_{1,2}(x)$
$x \in G_{1,2}$
$q = 2$
$\dot{x} = f_2(x, u)$
$x \in G_{2,1}$
$x := R_{2,1}(x)$
$x \in G_{2,3}$
$x := R_{2,3}(x)$
$\dot{x} = f_3(x, u)$
$x \in G_{3,1}$
$x := R_{3,1}(x)$
$q = 3$

Zeno Phenomenon



When is it Type 1 Zeno?

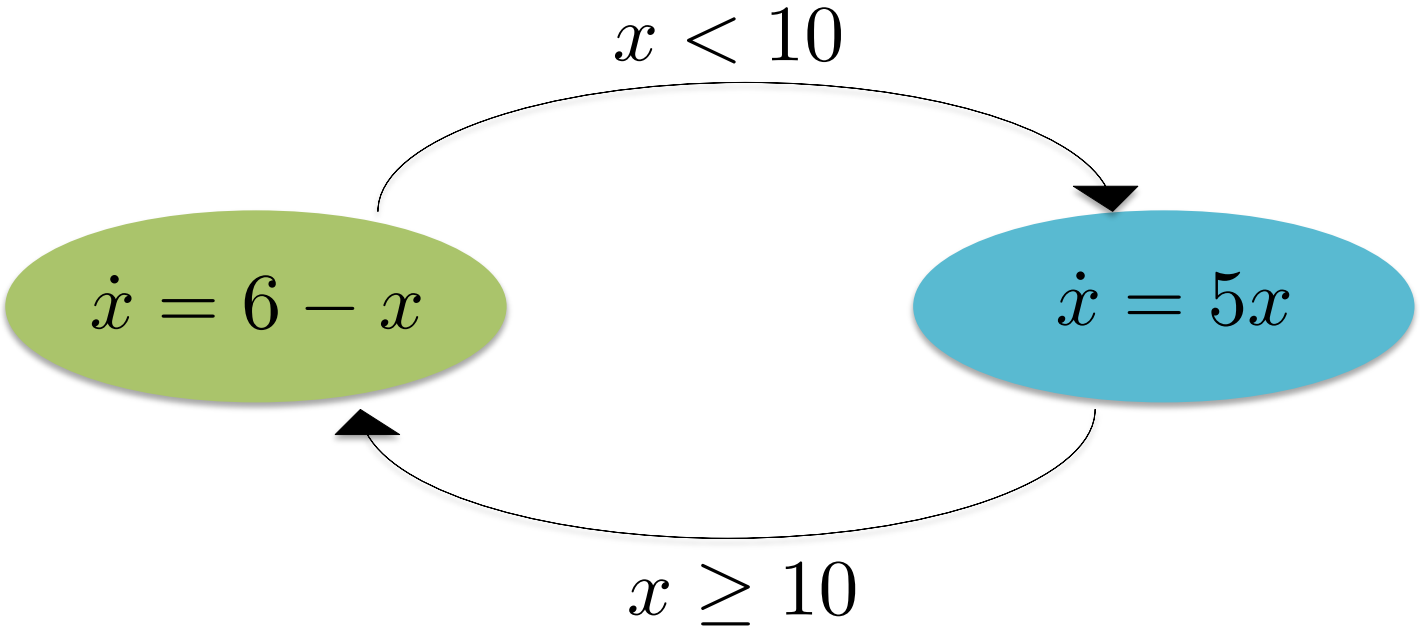


$$g(x) = 0$$

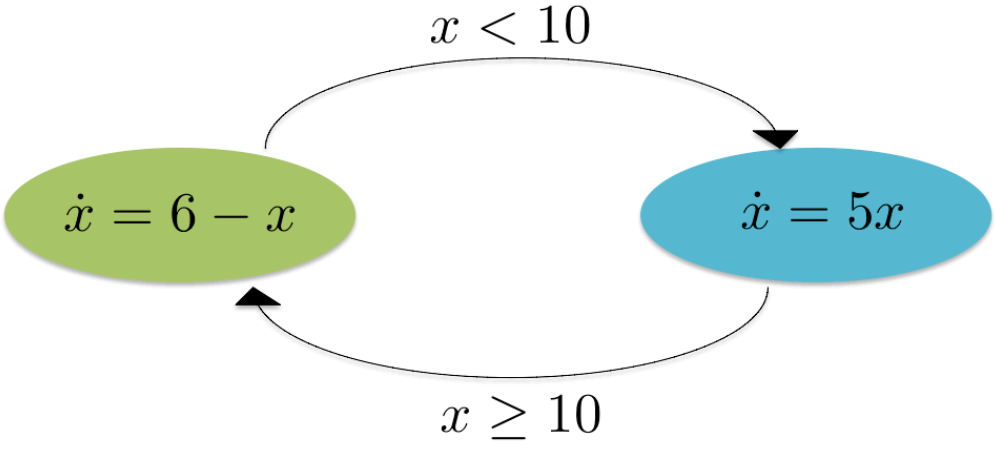
$$L_{f_1} g < 0 \wedge L_{f_2} g > 0$$

Must induce sliding mode

Example …



Example …



Check :

$$g(x) = 0$$

$$L_{f_1} g < 0 \wedge L_{f_2} g > 0$$

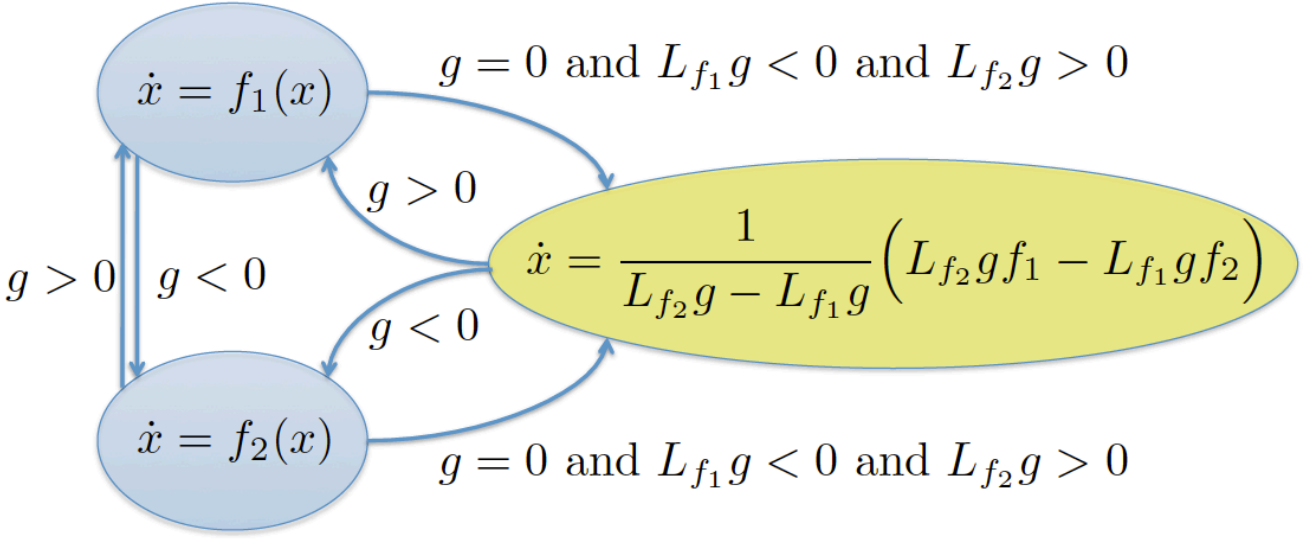
$$g(x) = 0 \Rightarrow x = 10$$

Must do sliding control !!!

$$L_{f_1} g = 6 - x < 0 \Rightarrow x > 6$$

$$L_{f_2} g = 5x > 0 \Rightarrow x > 0$$

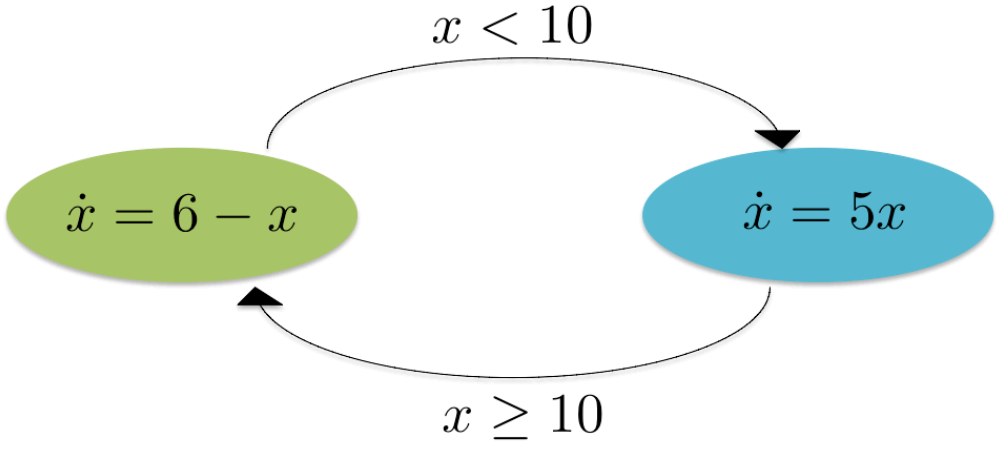
In general form …



$$\frac{dg}{dt} = 0$$

(to find dynamics)

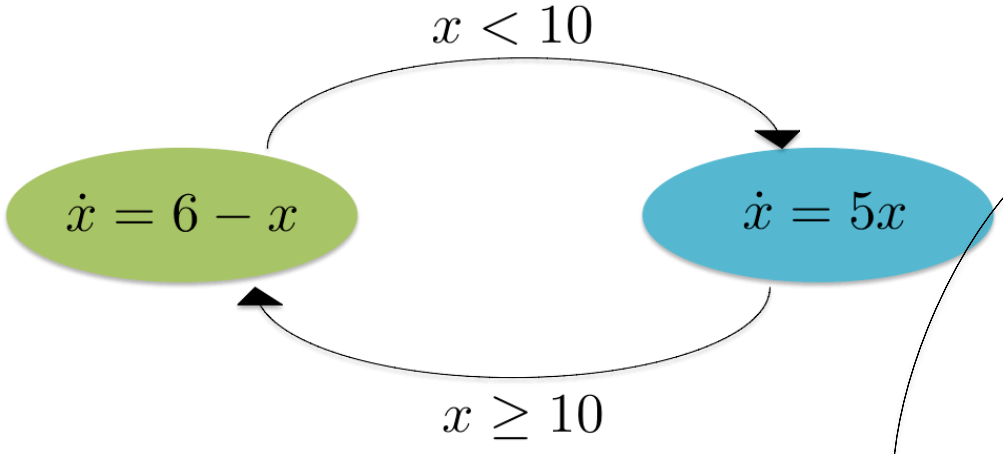
To find sliding mode dynamics …



$$\frac{dg}{dt} = 0 \quad \Rightarrow \dot{x} = 0$$

$$\dot{x} = \frac{1}{L_{f_2 g} - L_{f_1 g}} (L_{f_2 g} f_1 - L_{f_1 g} f_2)$$

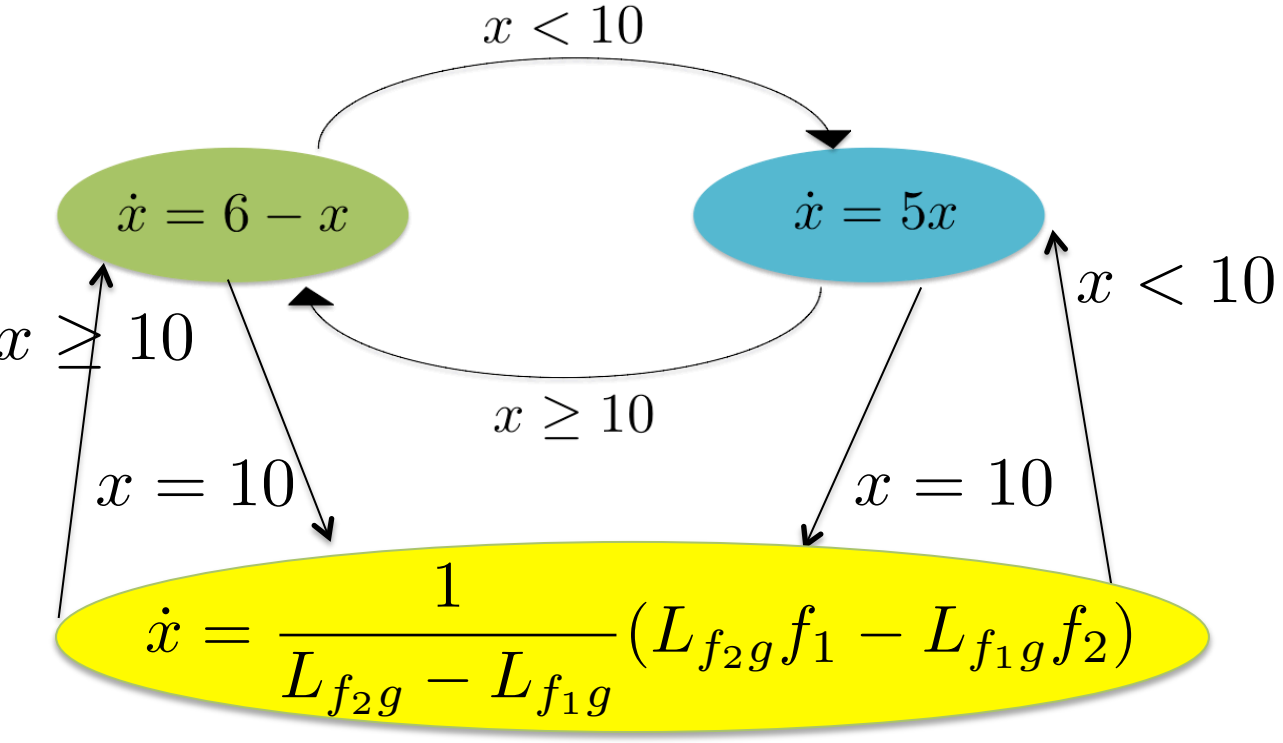
To find sliding mode dynamics …



$$L_{f_1 g} = 6 - x = f_1$$
$$L_{f_2 g} = 5x = f_2$$
$$\Rightarrow \dot{x} = 0$$

$$\dot{x} = \frac{1}{L_{f_2 g} - L_{f_1 g}} (L_{f_2 g} f_1 - L_{f_1 g} f_2)$$

All together …



Check the forums, and good luck with Quiz 5!