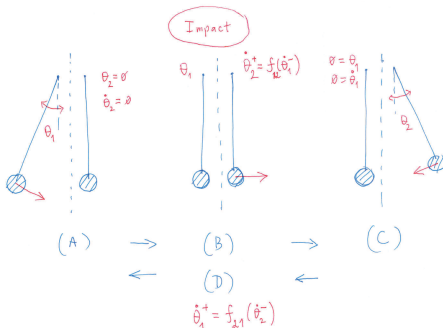


Exercise 6: Task 1

Consider a hybrid mechanical system consisting of two math pendulums

$$\ddot{\theta}_1 + \omega_1^2 \theta_1 = 0, \quad \ddot{\theta}_2 + \omega_2^2 \theta_2 = 0,$$

which behaviors are determined by the update functions $f_{21}(\cdot)$, $f_{12}(\cdot)$ and the switching rule depicted on Figure



Exercise 6: Task 1

The task is

- to derive the equations, which characterize initial conditions of a hybrid cycle in the system, if it exists;
- to verify that if the update laws are defined as

$$f_{21}(x) = -x + \delta \cdot x(1 + x), \quad f_{12}(x) = -x + \varepsilon \cdot x(1 + x),$$

then the system has a cycle with initial conditions at

$$\theta_1(0) = 0, \quad \dot{\theta}_1(0) = 1, \quad \theta_2(0) = 0, \quad \dot{\theta}_2(0) = 0;$$

- to derive the condition of an orbital stability of the cycle in terms of parameters ε , δ of the update laws $f_{21}(\cdot)$, $f_{12}(\cdot)$.