

State-Space Models

$$\dot{x} = Ax + Bu$$

$$y = Cx$$

where:

- ▶ $x(t) \in \mathbb{R}^n$ is the **state** at time t
- ▶ $u(t) \in \mathbb{R}^m$ is the **input** at time t
- ▶ $y(t) \in \mathbb{R}^p$ is the **output** at time t

and

- ▶ $A \in \mathbb{R}^{n \times n}$ is the **dynamics matrix**
- ▶ $B \in \mathbb{R}^{n \times m}$ is the **control matrix**
- ▶ $C \in \mathbb{R}^{p \times n}$ is the **sensor matrix**

How do we determine the output y for a given input u ?

Reminder: we will only consider **single-input, single-output (SISO)** systems, i.e., $u(t), y(t) \in \mathbb{R}$ for all times t of interest. ($m = p = 1$)