1 Equations of motion

$$m\dot{v} + bv = F(t) \tag{1}$$

$$\dot{x} = v \tag{2}$$

2 Define state variables

$$x_1 = x \tag{3}$$

$$x_2 = \dot{x} = v \tag{4}$$

$$\dot{x_1} = x_2 \tag{5}$$

$$\dot{x_2} = \dot{v} = \frac{F(t)}{m} - \frac{bx_2}{m} \tag{6}$$

$$y = x_1 \tag{7}$$

$$u = F(t) \tag{8}$$

3 State space form

$$\begin{bmatrix} \dot{x_1} \\ \dot{x_2} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & -\frac{b}{m} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{m} \end{bmatrix} u \tag{9}$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \end{bmatrix} u \tag{10}$$