Example 3, continued

State-space model:

$$\ddot{x} = -a_1\dot{x} - a_0 x + u \qquad y = b_1\dot{x} + b_0 x$$

$$x_1 = x, \ x_2 = \dot{x}$$

$$\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -a_0 & -a_1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 0 \\ 1 \end{pmatrix} u \qquad y = \begin{pmatrix} b_0 & b_1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$$

This is called *controller canonical form*.

▶ Easily generalizes to dimension > 1

▶ The reason behind the name will be made clear later in the semester