Finally, Pole Placement via State Feedback

Consider a state-space model

$$\dot{x} = Ax + Bu, \qquad x \in \mathbb{R}^n, u \in \mathbb{R}$$
$$y = x$$

Let's introduce a *state feedback law*

$$u = -Ky \equiv -Kx$$
$$= -\begin{pmatrix} k_1 & k_2 & \dots & k_n \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{pmatrix} = -(k_1 x_1 + \dots + k_n x_n)$$

Closed-loop system:

$$\dot{x} = Ax - BKx = (A - BK)x$$
$$y = x$$