

Observer and Controller

$$\text{System: } \dot{x} = Ax + Bu$$

$$y = Cx$$

$$\text{Observer: } \dot{\hat{x}} = (A - LC)\hat{x} + Ly + Bu$$

$$\text{Controller: } u = -K\hat{x}$$

The overall observer-controller system is:

$$\dot{\hat{x}} = (A - LC)\hat{x} + Ly + B \underbrace{(-K\hat{x})}_{=u}$$

$$= (A - LC - BK)\hat{x} + Ly$$

$$u = -K\hat{x} \quad (\text{dynamic output feedback})$$

— this is a dynamical system with **input** y and **output** u