

The Luenberger Observer

$$\text{System:} \quad \dot{x} = Ax$$

$$y = Cx$$

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

$$\text{Error:} \quad \dot{e} = (A - LC)e$$

Recall our assumption that $A - LC$ is Hurwitz (all eigenvalues are in LHP). This implies that

$$\|x(t) - \hat{x}(t)\|^2 = \|e(t)\|^2 = \sum_{i=1}^n |e_i(t)|^2 \xrightarrow{t \rightarrow \infty} 0$$

at an exponential rate, determined by the eigenvalues of $A - LC$.

For fast convergence, want eigenvalues of $A - LC$ far into LHP!!