The Luenberger Observer

$$\text{System:} \qquad \dot{x} = Ax$$
$$y = Cx$$
$$\text{Observer:} \qquad \dot{\widehat{x}} = (A - LC)\widehat{x} + Ly$$
$$\text{Error:} \qquad \dot{e} = (A - LC)e$$

Observer transfer function:

$$s\widehat{X}(s) = (A - LC)\widehat{X}(s) + LY(s)$$
$$(Is - A + LC)\widehat{X}(s) = LY(s)$$
$$\widehat{X}(s) = (Is - A + LC)^{-1}LY(s).$$

The eigenvalues of $A - LC$ are the observer poles. We want these poles to be *stable* and *fast*.