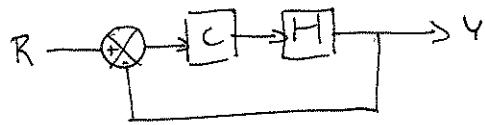
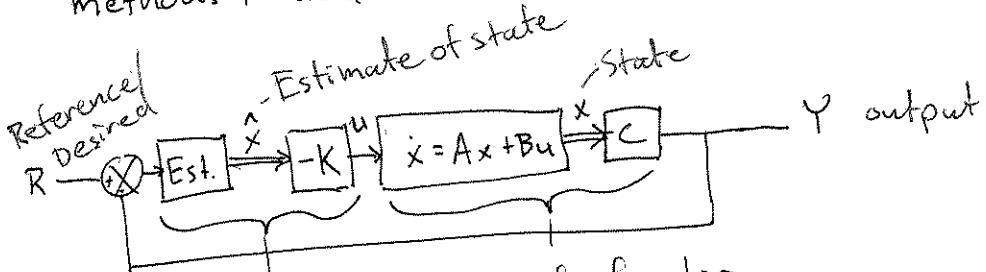


So far we've only looked at SISO feedback:



But lots of things aren't SISO, and we have state-space methods to deal with them.



Formerly: controller Transfer function
 Now : "compensation" Plant (although this isn't new)

We're going to approach this in 2 phases:

- 1- Given perfect knowledge of the state, can we/how do we control the system?
 i.e. can we determine the locations of the poles?
- 2- Given imperfect knowledge of the state, how do we construct an estimate of the state? (Given $Y = CX$, construct \hat{X})

Controllability

A system is controllable if there exists some input u which can move the system to any state x in finite time.

The system $\dot{x} = Ax + Bu$ is controllable iff rank of

$$[B \ AB \ A^2B \ \dots \ A^{n-1}B]$$

is rank n . (Derivation in Ogata 9-6)

Examples from Ogata:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

$$\begin{bmatrix} 1 & 1 \\ 2 & -1 \end{bmatrix} \quad \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

What about

$$\begin{bmatrix} 1 & 1 \\ 0.001 & -1 \end{bmatrix} \quad \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$