

- Monday 12/12 7pm Review JEC4304

- Project due at 5pm 12/12

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$$\min_u \int_0^{\infty} (x^T Q x + u^T R u) dt$$

$$\underline{u = -Kx}$$

$$Q = \begin{bmatrix} q_{11} & & & \\ & q_{22} & & \\ & & & \\ & & & q_{44} \end{bmatrix}$$

$$q_i > 0$$

$$R = \begin{bmatrix} r_1 & & \\ & & \\ & & r_2 \end{bmatrix}$$

$$r_i > 0$$

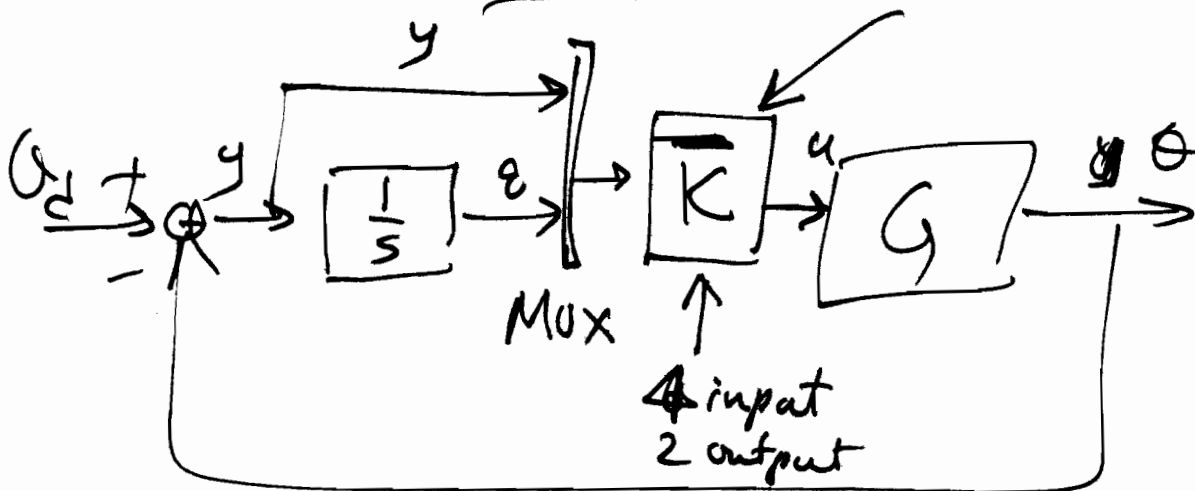
$$\dot{x} = Ax + Bu$$

$$y = Cx$$

$$\dot{q} = y = Cx$$

$$\begin{bmatrix} \dot{x} \\ \dot{q} \end{bmatrix} = \begin{bmatrix} A & 0 \\ C & 0 \end{bmatrix} \begin{bmatrix} x \\ q \end{bmatrix} + \begin{bmatrix} B \\ 0 \end{bmatrix} u$$

$$\begin{bmatrix} y \\ q \end{bmatrix} = \begin{bmatrix} C & 0 \\ 0 & I \end{bmatrix} \begin{bmatrix} x \\ q \end{bmatrix}$$



NL  
Simulink

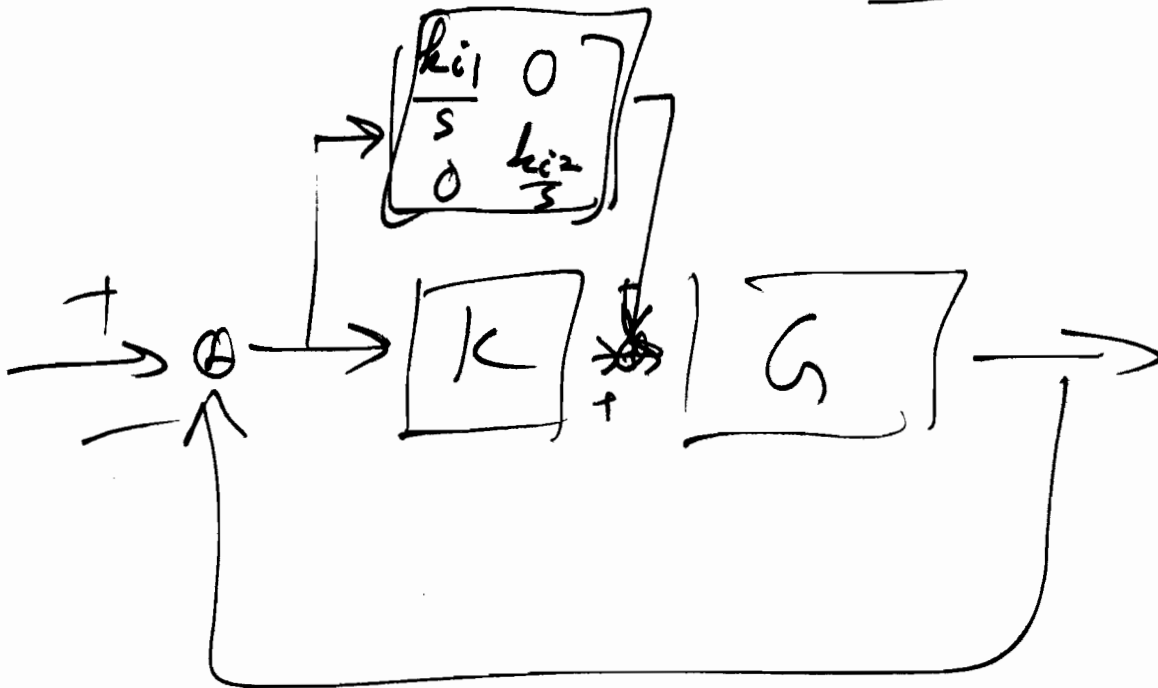
$2 \times N$  # of samples  
ynl1  
to workspace  
Scope

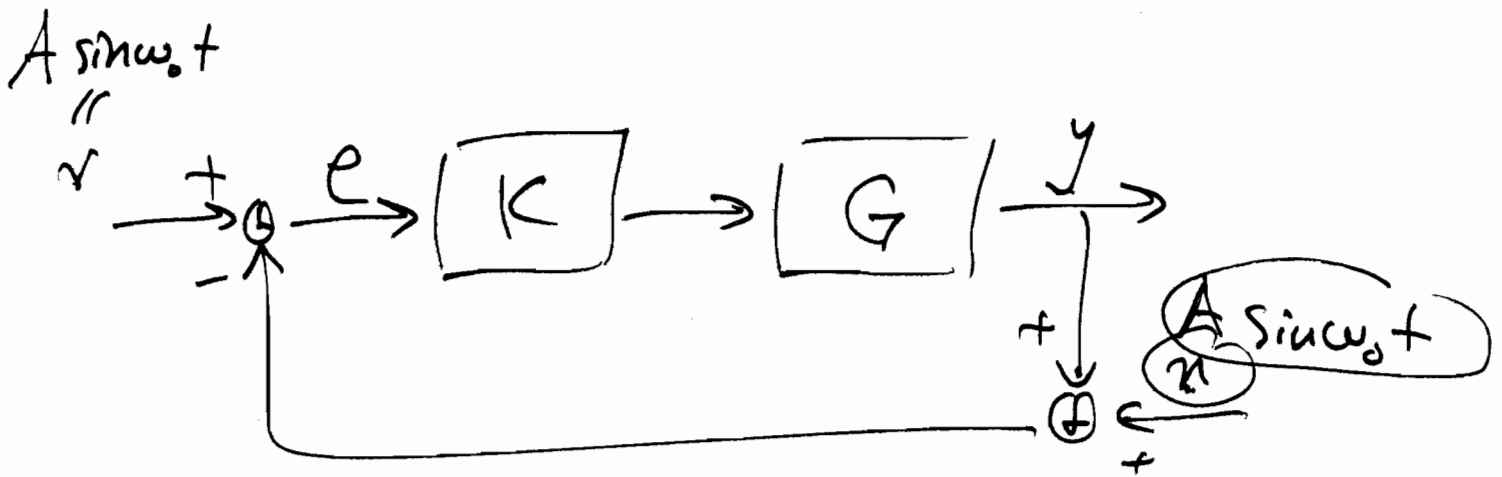
ynl1(:,1)

apply tstats

ynl1(:,2)

Make it small





Sensor noise  $\rightarrow$  output

$$y = -GK(y+n)$$

$$= -(\underline{I + GK})^{-1} GK n$$

tracking error

$$e = r - GK e$$

$$e = \underbrace{\left( \frac{1}{I + GK} \right)}_{S'(s)} r$$

$$r = \underline{A \sin \omega_0 t}$$

$$e = A \underbrace{|S'(j\omega_0)|}_{\underline{\quad}} \sin(\omega_0 t + \underbrace{\angle S(j\omega_0)}_{\underline{\quad}})$$

$$\left| \left( I + \underline{G(j\omega_0)} \underline{K(j\omega_0)} \right)^{-1} \right|$$

