Final Exam

- Root Locus
- Bode plots
- Nyquist plots
- Gain/phase margin
- 2nd order system response
- Linearization
- state space design
- Control design
  - range of gain for stability ← Routh Criterion
  - rise/peak time/settling time/overshoot
- Different representations of an LTI system
  - input/output differential equation
    $\dddot{x} + 3\ddot{x} - 2\dot{x} + 3x = 3\dot{u} - u$
  - impulse response $\delta \to$ [ ] $\to h$
  - transfer function $\mathcal{L}[h]$
  - state space
- Final Value Theorem

Sat.

- (A_d, B_d, C_d, D_d) ← discretized controller
- sampling period
- θ_d

2 inputs
2 outputs

(a_0, a_1, a_2, a_3, T)

(use save command)

save <filename> <list of variables>

CII 8208

Sat

11-12 Yena/Gina (2) 3-4 John Wasan (1)

12-1 Ian/David (2)

1-2 Anson/- -(2)

2-3 Paul/Joe (2)

Sun 12-1 Rich (1)

1-2 Eric/Andre (2)

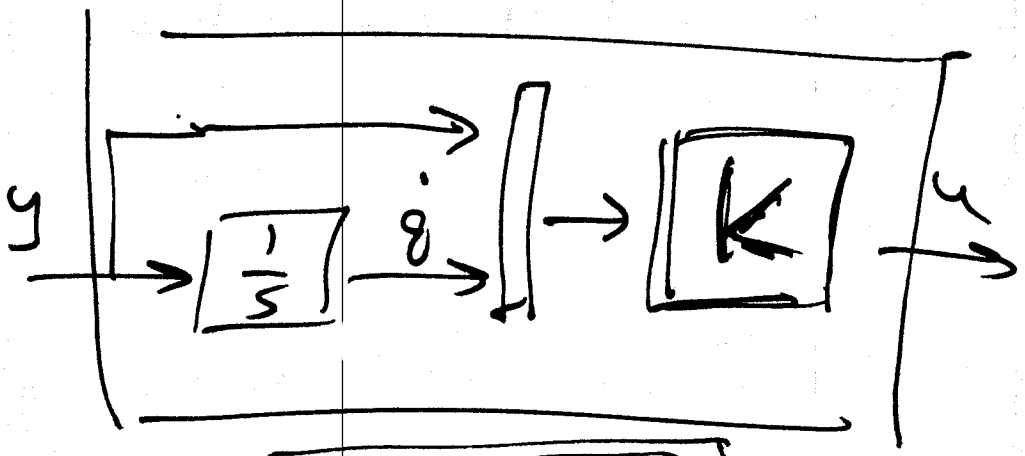
2-3 Laura (2)

3-4 Johnkua (2)

4-5 Ankur (2)

5-6 John (2)

(Joe)
2 hour @ rpi.edu
TW's cell
441-0470

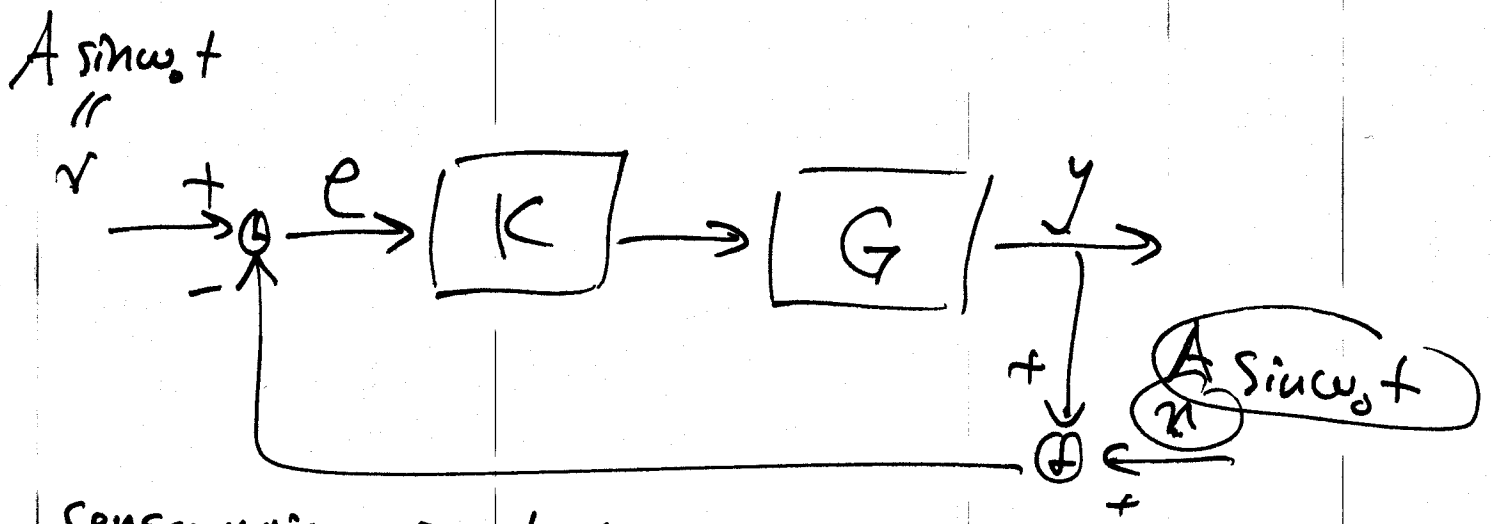


$$\begin{bmatrix} u_1 \\ u_2 \end{bmatrix} = \underbrace{K(s)}_{2 \times 4} \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ \frac{1}{s} & 0 \\ 0 & \frac{1}{s} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \end{bmatrix}$$

$$\underbrace{2 \times 2}_{K1}$$

```
K1 = ss(K * [1 0; 0 1; tf(1,[1 0]) 0;
                       0 tf(1,[1,0])]);
```

K1.a K1.b K1.c K1.d



Sensor noise → output

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

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

tracking error

$$e = r - GKe$$

$$e = (I+GK)^{-1} r$$

$$S(s)$$

$$r = A\sin\omega_0 t$$

$$e = A\,|S(j\omega_0)|\sin(\omega_0 t + \angle S(j\omega_0))$$

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