

# Control Notes

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## 1 Full-State Feedback

## 2 Laplace Transfer and Z Transfer

$$\begin{aligned}z &= e^{sT} \\s &= \ln(z)/T\end{aligned}$$

## 3 Estimator and Controller

$$\begin{aligned}\hat{x}_{k+1}^+ &= F\hat{x}_k^+ + Gu_k + L(y_k - H\hat{x}_k^+) \\u_k &= -K\hat{x}_k^+\end{aligned}$$

Controller (state-error) dynamics:  $F - GK$

Estimator (estimator-error) dynamics:  $F - LH$

The estimator-error dynamics should be faster than the controller-error dynamics.

Observability Matrix (discrete)

$$\mathcal{O} = \begin{pmatrix} H \\ HF \\ HF^2 \\ \dots \\ HF^{n-1} \end{pmatrix}$$

Controllability Matrix (discrete): convergence and stability of error

$$\mathcal{C} = \begin{pmatrix} G \\ FG \\ F^2G \\ \dots \\ F^{n-1}G \end{pmatrix}$$

## 4 Questions

1. Pf: 20-0.5; Euler integration;
2. B tilde for discretion