

Day 33

Transfer function

AE 353

Spring 2022

Bretl

35.329
35.997

32.96
33.41

33.41
39.72

ω	MAG	ANG
1	1.12	-0.45
2	1.22	-1.34
5	0.22	-2.76

7.142
8.394

6.593

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

$$u = u_{des} - K(x - x_{des})$$

$$x_{des} = \begin{bmatrix} q_{des} \\ 0 \end{bmatrix} = \begin{bmatrix} \overbrace{1}^M \\ 0 \end{bmatrix} \overbrace{[q_{des}]}^r$$

$$\dot{x} = Ax + B(u_{des} - K(x - Mr))$$

$$= (A - BK)x + \underbrace{Bu_{des}}_{-Ax_{des} = -AMr} + BKM r$$

$$0 = Ax_{des} + Bu_{des}$$

$$-Ax_{des} = -AMr$$

$$\begin{aligned} \dot{x} &= \overbrace{(A - BK)}^{A_m} x - \overbrace{(A - BK)M}^{B_m} r \\ y &= \underbrace{M^T}_{C_m} x \end{aligned}$$

$$\dot{x}_m = A_m x_m + B_m u_m$$

$$y_m = C_m x_m$$

$$\dot{x}_m = A_m x_m + B_m u_m$$

$$y_m = C_m x_m$$

GENERAL RESULT

transient
(decays to zero)

$$u_m(t) = \sin(\omega t) \Rightarrow y_m(t) = (\dots) + |H(j\omega)| \sin(\omega t + \angle H(j\omega))$$

$$u_m(t) = \cos(\omega t) \Rightarrow y_m(t) = (\dots) + |H(j\omega)| \cos(\omega t + \angle H(j\omega))$$

magnitude

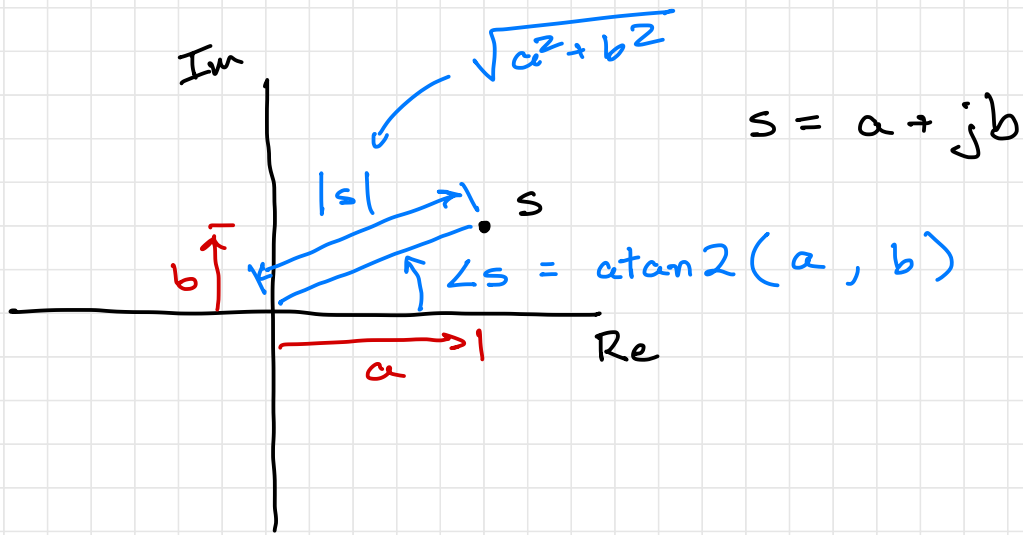
angle

a complex number

$$H(s) = C_m (sI - A_m)^{-1} B_m$$

TRANSFER FUNCTION

another complex number



$$s = |s| e^{j\angle s}$$

$$= |s| (\cos(\angle s) + j \sin(\angle s))$$