Tue Apr 19

AA/ECE/ME 548 Linear Multivariable Control Sp 22 Prof Burden

today:
- [x] course logistics, Canvas, etc
- [x] exam 1 next week
- [ ] HW 2 self-assessment – due next Monday
- [ ] HW 3 – due this Friday
- [ ] week 4 lectures
- [ ] questions / office hours

- [x] HW1 solution ⇝ Canvas
- [ ] 2π in p1(a)

TODO:
- [ ] link notebooks / point to Python intro
- [ ] ECE Colloq
- [ ] Robotics Colloquium
- [ ] Northwest Robotics Symp.

$w \in \mathbb{R}^2$, $z \in \mathbb{R}^2$

$$\therefore T_{wz} = -\frac{1}{s+1}\begin{bmatrix} 1 & a \\ -a & 1 \end{bmatrix} = \begin{bmatrix} T_{w_1 z_1} & T_{w_1 z_2} \\ T_{w_2 z_1} & T_{w_2 z_2} \end{bmatrix}$$

This implies that $T_{w_1,z_1} = T_{w_2,z_2} = -\frac{1}{s+1}$.

$$w = T_{wz} \cdot z$$

$$\Updownarrow$$

$$\begin{bmatrix} w_1 \\ w_2 \end{bmatrix} = \begin{bmatrix} T_{w_1 z_1} \cdot z_1 + T_{w_1 z_2} \cdot z_2 \\ T_{w_2 z_1} \cdot z_1 + T_{w_2 z_2} \cdot z_2 \end{bmatrix}$$

multiple notions of stability:

$$\dot{x} = Ax + Bu \xrightarrow[\text{output stability}]{y = Cx + Du}$$

state space stability

$$\operatorname{spec} A \subset \mathbb{C}_0^-$$

$$\Downarrow$$

asymptotically
$\Leftrightarrow$ exponentially stable
$\Leftrightarrow$ internally stable $\Longrightarrow$ BIBO stable

$$\xrightarrow{u} \boxed{T} \longrightarrow y = T(u)$$

BIBO stability

$$* \quad \max_{\substack{u \neq 0 \\ u \in L_2}} \frac{\|T(u)\|}{\|u\|} \overset{?}{<} \infty$$

$$u : \mathbb{R} \to \mathbb{R}^m : \quad \|u\|_2^2 = \int \|u(t)\|_2^2 \, dt$$