2. Brunowsky canonical form (SISO)

venerdì 3 luglio 2020 18:27

Consider a MIMO system

$$\begin{cases} \dot{x} = Ax + Bu \\ y = Cx \end{cases} \qquad A \in \mathbb{R}^{n \times n} \quad B \in \mathbb{R}^{n \times p} \quad C \in \mathbb{R}^{q \times n}$$

for simplicity assuming $p = 2$

for SISO systems the Brunowsky canonical form is a simple cascade of integrators

(A, B) reachable $\rightarrow \exists F^0 = -\gamma A^n$ and a transformation T such that:

$$\sigma(A + BF^0) = \{0, \dots, 0\}$$

$$T = \begin{pmatrix} \gamma \\ \vdots \\ \gamma A^{n-1} \end{pmatrix} \qquad T \cdot \sigma(A + BF^0) \cdot T^{-1} = \begin{pmatrix} 0 & 1 & \cdots & 0 \\ 0 & & \ddots & \vdots \\ \vdots & & & 1 \\ 0 & 0 & \cdots & 0 \end{pmatrix} = A_B$$

$$TB = \begin{pmatrix} 0 \\ \vdots \\ 1 \end{pmatrix}$$

Any controllable system admits this form

for MIMO SYSTEMS it can be written as the combination of Brunowsky blocks.