Teoria Regulacji - Ćwiczenia

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Zadanie 2

a) Hurwitz

a) $K_o(o) = \frac{1}{(s+1)(s+2)(s+3)}$, $K_k(s) = k$

$$K_{OTW}(s) = \frac{k}{s^3 + 6s^2 + 11s + 6}$$

$$M_{UAR} = L_{OTW}(s) + M_{OTW}(s) = (s+1)(s+2)(s+3) + k = s^3 + 6s^2 + 11s + 6 + k$$

$$H_3 = \begin{bmatrix} 6 & 6+k & 0 \\ 1 & 11 & 0 \\ 0 & 6 & 6+k \end{bmatrix}$$

$$\begin{cases} \Delta_1 = 6 > 0 \\ \Delta_2 = 60 + k > 0 \rightarrow k > -60 \\ \Delta_3 = (6+k) \cdot \Delta_2 = (6+k)(60+k) \rightarrow k > -6 \ lub \ k < -60 \end{cases}$$

$$k \in (-6, 60)$$

b) $K_o(s) = \frac{1}{(s+1)^2(s+2)}$, $K_R(s) = k$

$$K_{OTW}(s) = \frac{k}{(s+1)^2(s+2)}$$

$$M_{UAR}(s) = L_{OTW}(s) + M_{OTW}(s) = s^3 + 4s^2 + 5s + 2 + k$$

$$H_3 = \begin{bmatrix} 4 & 2+k & 0 \\ 1 & 5 & 0 \\ 0 & 4 & 2+k \end{bmatrix}$$

$$\begin{cases} \Delta_1 = 4 > 0 \\ \Delta_2 = 18 - k > 0 \rightarrow k < 18 \\ \Delta_3 = (2+k) \cdot \Delta_2 = (2+k)(18-k) \rightarrow k > -2 \ lub \ k < 18 \end{cases}$$

$$k \in (-2, 18)$$

b) Nyquist

Zadanie 3

Zadanie 4