Diagram lege korenov

$$G(s)H(s) = K\frac{\prod_{i=1}^{m}(s+z_i)}{\prod_{i=1}^{n}(s+p_i)}$$

$$1 + G(s)H(s) = 0$$

$$|G(s)H(s)| = 1$$

$$\angle[G(s)H(s)] = \pm 180°(2k+1)$$

$$\beta_k = \frac{\mp 180°\,(2k+1)}{n-m};\ \sigma_a = -\frac{\sum_{i=1}^{n} p_i - \sum_{i=1}^{m} z_i}{n-m}$$

$$\left.\frac{dK}{ds}\right|_{s=\sigma_b} = 0;\ \sum_{i=1}^{n}\frac{1}{\sigma_b+p_i} = \sum_{i=1}^{m}\frac{1}{\sigma_b+z_i}$$

$$\Theta_{izh} = 180° + \sum \phi_{z_i} - \sum \Theta_{p_i}$$

$$\phi_{vst} = 180° - \sum \phi_{z_i} + \sum \Theta_{p_i}$$

Analiza sistemov v frekvenčnem prostoru

$$G(j\omega) = K\frac{\prod_{i=1}^{m}(j\omega+z_i)}{(j\omega)^l\prod_{i=1}^{n}(j\omega+p_i)} = K\frac{\prod_{i=1}^{m} z_i}{\prod_{i=1}^{n} p_i}\frac{\prod_{i=1}^{m}(1+\frac{j\omega}{z_i})}{(j\omega)^l\prod_{i=1}^{n}(1+\frac{j\omega}{p_i})}$$

$$L(\omega) = 20\log|G(j\omega)|\ \mathrm{dB}$$

$$\phi(\omega) = \mathrm{arctg}\frac{Im(G(j\omega))}{Re(G(j\omega))}$$

Relativna stabilnost

$$\phi_\mathrm{m} = 180° + \phi(\omega_1);\ |G(j\omega_1)H(j\omega_1)| = 1$$

$$\mathrm{K_m} = \frac{1}{|\mathrm{G}(\mathrm{j}\omega_\pi)\mathrm{H}(\mathrm{j}\omega_\pi)|};\ \phi(\omega_\pi) = -180°$$

Nyquistov stabilnostni kriterij

$$Z_{-1} = N_{-1} + \mathrm{P}_0$$

Kompenzacijske metode

$$\lambda = \phi - \Theta$$

$$\sin\phi_{max} = \frac{1-\alpha}{1+\alpha}$$

$$\omega_{max} = \frac{1}{\sqrt{\alpha}T}$$

$$\psi = \arccos(-\zeta)$$

Lastnosti sistemov

$t_r \approx \frac{2}{\omega_n}$; za $\zeta < 0{,}5$

$t_{s,2\,\%} \approx \frac{4}{\omega_n\zeta}, t_{s,5\,\%} \approx \frac{3}{\omega_n\zeta}$; za $\zeta < 1$

$M_p = e^{-\zeta\frac{\pi}{\sqrt{1-\zeta^2}}}$; za $\zeta < 1$

$$s_{1,2} = -\zeta\omega_n \pm j\omega_n\sqrt{1-\zeta^2}$$

$$M_r = \frac{1}{2\zeta\sqrt{1-\zeta^2}}, \omega_r = \omega_n\sqrt{1-2\zeta^2}$$

$$\omega_b\!: 20\log\left|\frac{C(j\omega_b)}{R(j\omega_b)}\right|\ \mathrm{dB} = 20\log\left|\frac{C(j0)}{R(j0)}\right|\ \mathrm{dB} - 3\ \mathrm{dB}$$

Prostor stanj

$$u(t) = -Kx(t)\ ;\ A_f = A - BK$$

$$|sI - A_f| = \phi(s)\ ;\ \phi(s) = (s+\mu_1)(s+\mu_2)\ \dots\ (s+\mu)$$

$$G(s) = \frac{b_0s^n + b_1s^{n-1} + \dots + b_{n-1}s + b_n}{s^n + a_1s^{n-1} + \dots + a_{n-1}s + a_n}$$

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 & \cdots & 0 \\ 0 & 0 & 1 & \cdots & 0 \\ \vdots & \vdots & \vdots & & \vdots \\ 0 & 0 & 0 & \cdots & 1 \\ -a_n & -a_{n-1} & -a_{n-2} & \cdots & -a_1 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ \vdots \\ 0 \\ 1 \end{bmatrix} u(t)$$

$$y(t) = [b_n - a_nb_0 \quad b_{n-1} - a_{n-1}b_0 \quad \cdots \quad b_1 - a_1b_0]x(t) + b_0u(t)$$

$$Q_v = [B \quad AB \quad A^2B \quad \cdots \quad A^{n-1}B]$$

$$Q_s = \begin{bmatrix} C \\ CA \\ CA^2 \\ \cdots \\ CA^{n-1} \end{bmatrix}$$

$$K = [0 \quad 0 \quad \cdots \quad 0 \quad 1]{Q_v}^{-1}\phi(A)$$

Transformacija spremenljivk stanj

$$x_t(t) = T^{-1}x(t)$$

$$A_t = T^{-1}AT\ ;\ B_t = T^{-1}B$$

$$C_t = CT;\ D_t = D$$

Observator

$$\dot{\hat{x}}(t) = A\hat{x}(t) + Bu(t) + H(y(t) - C\hat{x}(t))$$

$$H = \phi(A){Q_s}^{-1}[0 \quad 0 \quad \cdots \quad 0 \quad 1]^T$$