NP karakteristična formula

$$T(s) = \frac{k \cdot \omega_p^2}{s^2 + \frac{\omega_p}{q_p} s + \omega_p^2}$$

VP karakteristična formula

$$T(s) = \frac{k \cdot s^2}{s^2 + \frac{\omega_p}{q_p} s + \omega_p^2}$$

PP karakteristična formula

$$T(s) = \frac{k \cdot \frac{\omega_p}{q_p} s}{s^2 + \frac{\omega_p}{q_p} s + \omega_p^2}$$

PB karakteristična formula

$$T(s) = \frac{k \cdot (s^2 + \omega_p^2)}{s^2 + \frac{\omega_p}{q_p} s + \omega_p^2}$$

Denormalizacija frekvencije

$$s \to \frac{s}{\omega_g} \quad , \qquad \omega_g = 2\pi f_g$$

Denormalizacija R, L, C

$$R = R_0 \cdot R_n \qquad C = \frac{C_n}{\omega_0 \cdot R_0} \qquad L = \frac{L_n \cdot R_0}{\omega_0}$$

NP -> VP

$$s \to \frac{\omega_g}{s}$$

NP -> PP

$$s \to \frac{s^2 + \omega_0^2}{Bs} \quad , \qquad B = 2\pi(f_g - f_d)$$

NP -> PB

$$s \to \frac{Bs}{s^2 + \omega_0^2} \quad , \qquad B = 2\pi(f_g - f_d)$$

$$B = \frac{\omega_p}{q_p}$$

$$\omega_{g,d} = \omega_p \sqrt{1 + \frac{1}{4q_p^2}} \pm \frac{\omega_p}{2q_p}$$

$$B = \omega_g - \omega_d$$

Butterworthova aproksimacija

$$|H_n(j\omega)| = \frac{1}{\sqrt{1 + \left(\frac{\omega}{\omega_g}\right)^{2N}}}$$

$$s_{pk} = -\sin\left(\frac{2k-1}{2N}\pi\right) + \mathrm{j} \cdot \cos\left(\frac{2k-1}{2N}\pi\right), \; k = 1, \ldots, N$$

Chebyshevljeva aproksimacija

$$|H_n(j\omega)| = \frac{1}{\sqrt{1 + \varepsilon^2 T_n^2(\omega)}}$$

Za parni red N

$$\omega = 0 \quad H(0) = \frac{1}{\sqrt{1 + \varepsilon^2}}$$

Za neparni red N

$$\omega = 0 \quad H(0) = 1$$

$$\Phi_n = \frac{1}{n} \ln\left(\frac{1}{\varepsilon} + \sqrt{1 + \frac{1}{\varepsilon^2}}\right)$$

$$s_{pk} = -\sinh(\Phi_n) \sin\left(\frac{2k-1}{2N}\pi\right) + \mathrm{j} \cdot \cosh(\Phi_n) \cos\left(\frac{2k-1}{2N}\pi\right), \quad k = 1, \ldots, N$$

Geffeove formule (NP -> PP)

$$q_p = \frac{q_{NP}}{B\omega_{NP}} \cdot \sqrt{\frac{(4\omega_0^2 + B^2\omega_{NP}^2) + \sqrt{(4\omega_0^2 + B^2\omega_{NP}^2)^2 - 4\frac{B^2\omega_{NP}^2\omega_0^2}{q_{NP}^2}}}{2}}$$

$$A = \frac{\omega_{p1}}{\omega_0} = \frac{\omega_0}{\omega_{p2}} = \frac{\frac{Bq_p\omega_{NP}}{\omega_0 q_{NP}} + \sqrt{\left(\frac{Bq_p\omega_{NP}}{\omega_0 q_{NP}}\right)^2 - 4}}{2}$$