EERI 418 Memorandum

Semester test 3 – 26 May 2015

Vraag / *Question* 1

Fase-naloop met $\phi_m = 40°$

$k =$

$\phi = -180° + \phi_m + 5° = -180° + 40° + 5° = -135°$ ✓

Dus $\omega_{w1} \approx 2,8$ rad/s ✓

Nou $\omega_{w0} = 0,1\,\omega_{w1} = 0,28$ rad/s ✓

By ω_{w1} moet $|D(j\omega_{w1})\,G(j\omega_{w1})| = 1$

Aangesien $k = 3$ moet die waarde van $|G(j\omega_{w1})|$ met $20\log 3$ gelig word vanaf die afgelese waarde. ✓

✓ Dus $|G(j\omega_{w1})| = -3\,dB + 20\log 3\,dB = 6,54\,dB$

$= 2,123$

$$\therefore \omega_{wp} = \frac{0,1\,\omega_{w1}}{a_0\,|G(j\omega_{w1})|} = \frac{0,1 \cdot 2,8}{1 \cdot 2,123}\ \text{rad/s}$$

$= 0,134$ rad/s. ✓

$$\therefore K_d = 1\left[\frac{0,134\left(0,28 + \frac{2}{0,125}\right)}{0,28\left(0,134 + \frac{2}{0,125}\right)}\right] = 0,479$$ ✓

$$z_0 = \frac{\frac{2}{0,125} - 0,28}{\frac{2}{0,125} + 0,28} = 0,9656$$ ✓

$$z_p = \frac{\frac{2}{0,125} - 0,134}{\frac{2}{0,125} + 0,134} = 0,984$$ ✓

$$\therefore D(z) = \frac{0,479\,(z - 0,9656)}{(z - 0,984)}$$ ✓

[10]

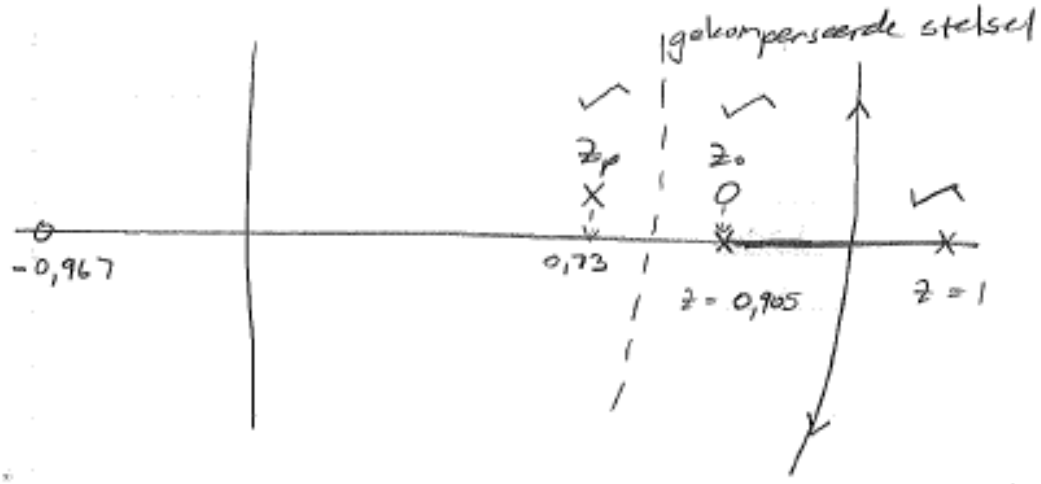
Vraag / *Question* 2

$$G_p(s) = \frac{k}{s(s+4)}$$

$$G(z) = \mathcal{Z}\left[\frac{1-e^{-sT}}{s} \cdot \frac{k}{s(s+4)}\right]$$

$$= \frac{z-1}{z} \cdot \mathcal{Z}\left[\frac{k}{s^2(s+4)}\right] \quad T = 0{,}025\ s.$$

$$= \frac{k \cdot 0{,}000302\,(z+0{,}967)}{(z-1)(z-0{,}905)}$$



By benadering is die uegbreekpunt (punt van kritiese demping) $\frac{0{,}905+1}{2} = 0{,}953$

Vir die poolposisies $z = e^{-\frac{T}{\tau}}$

$0{,}953 = e^{-\frac{0{,}025}{\tau}}$

$\therefore \tau = 0{,}52\ s$

Fase voorlapnetwerk Kies $z_0 = 0{,}905$ om op die bestaande pool te lê.

Om die respons tyd met 'n faktor 3 te verminder

$T_{new} \simeq \frac{952}{3} = 0{,}173\ s.$

$\therefore$ Nuwe uegbreekpunt $\simeq z = e^{-\frac{T}{\tau}} = e^{\frac{-0{,}025}{0{,}173}} = 0{,}865$

$\therefore \frac{z_p + 1}{2} \simeq 0{,}865$ ✓

$\therefore z_p = 0{,}73$ ✓

$\therefore D(z) = \frac{k_d(z - z_0)}{z - z_p} = \frac{k_d(z - 0{,}905)}{z - 0{,}73}$ ✓

Vir $D(1) = 1 \quad k_d = 2{,}842$ ✓

$\therefore D(z) = \frac{2{,}842(z - 0{,}905)}{(z - 0{,}73)}$ ✓

Op wortellokus $1 + D(z)\,G(z) = 0$.

$\therefore$ By $z_0 = 0{,}865$

$|D(z_0)\,G(z_0)| = 1$ ✓

$K = \frac{|z - 1||z - 0{,}73|}{2{,}842 \cdot 0{,}000302|(z + 0{,}967)|}\Big|_{z = 0{,}865}$ ✓

$= 11{,}6$ ✓ [15]

[25]