

0.1 PECS Simulation Math

Calculations from Tasks 5 - 8:

$$c_{max} = 5.930\,85\,\text{V} - 5\,\text{V}$$

$$c_{max} = 0.930\,85\,\text{V}$$

$$c_{final} = 5.5\,\text{V} - 5\,\text{V}$$

$$c_{final} = 0.5\,\text{V}$$

$$\%OS = \frac{0.930\,85\,\text{V} - 0.5\,\text{V}}{0.5\,\text{V}} \cdot 100$$

$$\%OS = 86.17\%$$

$$\zeta = \frac{-\ln(86.17/100)}{\sqrt{\pi^2 + \ln^2(86.17/100)}}$$

$$\zeta = 0.047327$$

$$0.5\,\text{V} * 0.02 = 0.01\,\text{V}$$

$$c_{final} \pm 2\% = 0.5\,\text{V} \pm 0.01\,\text{V}$$

$$c'_{final} \pm 2\% = 5.501\,\text{V} \text{ and } 5.499\,\text{V}$$

$$T_s = 0.140\,627\,\text{s} - 0.11\,\text{s}$$

$$T_s = 0.030\,627\,\text{s}$$

$$\omega_n = \frac{4}{0.047327 \cdot 0.030627}$$

$$\omega_n =$$

$$K = \frac{5.5\,\text{V} - 5\,\text{V}}{5.5\,\text{V} - 5\,\text{V}}$$

$$K = 1$$

0.2 MATLAB

Derivation of Transfer Function, symbolically:

$$Z_{RC} = (1/R + Cs)^{-1}$$

$$Z_{RC} = \frac{R}{sRC + 1}$$

$$Z_{EQ} = Ls + Z_{RC}$$

$$V_{\text{out}} = V_{\text{in}} \cdot \frac{Z_{RC}}{Z_{EQ}}$$

$$\frac{V_{\text{out}}}{V_{\text{in}}} = \frac{R}{RLCs^2 + Ls + R}$$

$$G(s) = \frac{1}{LCs^2 + \frac{L}{R}s + 1}$$

So, we can see $a_1 = L/R$ and $a_2 = LC$.

$$a_1 = \frac{560\mu}{25}$$

$$= 22.4\mu$$

and

$$a_2 = 560\mu \cdot 100\mu$$

$$= 56n$$

To determine the values for K , ζ , and ω_n :

$$\omega_n = \frac{1}{\sqrt{a_2}}$$

$$= 4.2258 \frac{rad}{sec}$$