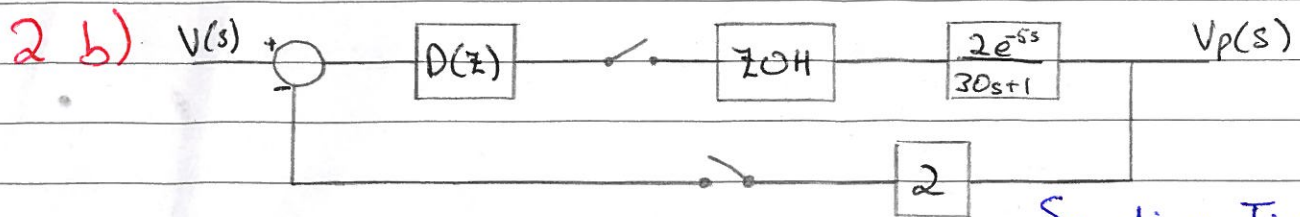


# EE 4002 Control Engineering Summer '08



Sampling Time = 2s

$$G(s) = \frac{2e^{-5s}}{30s+1}$$

$$NT + \Theta = 5$$

Choose  $N = 2$  samples

$$m = 1 - \frac{\Theta}{T} = 0.5$$

$$\lambda = 15s \Rightarrow T_{s2\%} = 60s$$

$$G(z) = Z_m \left\{ \frac{1-e^{-sT}}{s} \frac{2e^{-5s}}{30s+1} 2e^{-NTs} \right\}_{m=0.5}$$

$$= (1-z^{-1})(z^{-2}) 4 Z_m \left\{ \frac{1}{s(30s+1)} \right\}_{m=0.5}$$

$$= (1-z^{-1})(z^{-2}) \frac{4}{30} Z_m \left\{ \frac{1}{s(s+\frac{1}{30})} \right\}_{m=0.5}$$

$$= (1-z^{-1})(z^{-2}) \frac{4}{30} \left[ \frac{z^{-1}}{(\frac{1}{30})} \left( \frac{1}{1-z^{-1}} - \frac{e^{-\frac{1}{30}}}{1-e^{-\frac{1}{30}}z^{-1}} \right) \right]$$

$$= (1-z^{-1})(z^{-3}) 4 \left[ \frac{1}{1-z^{-1}} - \frac{0.967}{1-0.9355z^{-1}} \right]$$

$$= 4z^{-3} \left[ \frac{1-0.9355z^{-1}-0.967+0.967z^{-1}}{1-0.9355z^{-1}} \right] = 4z^{-3} \left[ \frac{0.033+0.0315z^{-1}}{1-0.9355z^{-1}} \right]$$

$$= \frac{4}{30} z^{-3} \left[ \frac{z+0.945}{z-0.9355} \right]$$

$$C/R = \frac{(1-e^{-T/\lambda})z^{-(N+1)}}{1-e^{-T/\lambda}z^{-1}}$$

$$\frac{C/R}{1-C/R} = \frac{(1-e^{-T/\lambda})z^{-(N+1)}}{1-e^{-T/\lambda}z^{-1}-(1-e^{-T/\lambda})z^{-(N+1)}}$$

$$= \frac{(1-e^{-2/15})z^{-3}}{1-e^{-2/15}z^{-1}-(1-e^{-2/15})z^{-3}} = \frac{0.125z^{-3}}{1-0.875z^{-1}-0.125z^{-3}}$$

$$= \frac{0.125}{(z-1)(z-[0.0625 \pm j0.348])}$$