

ELEN3016: CONTROL LAB 3

Group 7

Tyson Cross (1239448)

Jannes Smit (10382530)

Daniel de Barros (1036613)

1 Matlab Simulations

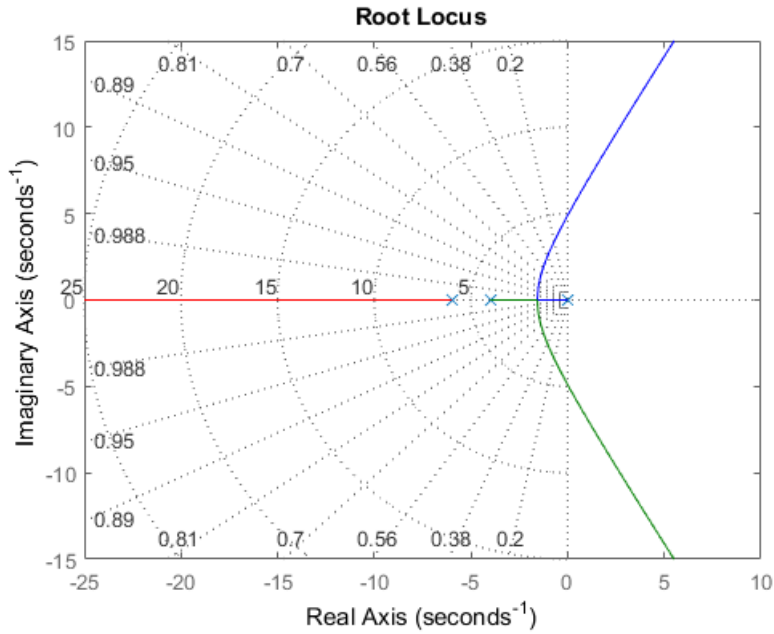


Figure 1: Root-Locus Plot of Plant

$$\%overshoot = 100 \times e^{\frac{-\zeta\pi}{\sqrt{1-\zeta^2}}} \quad (1)$$

$$\zeta = 0.358 \quad (2)$$

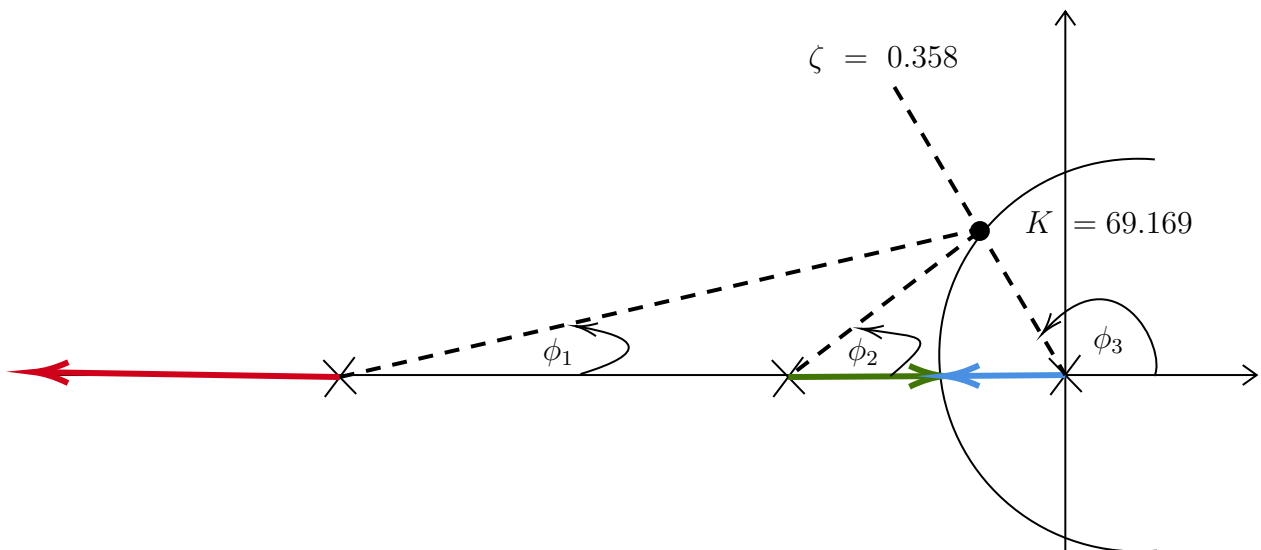


Figure 2: Intersection with Root Locus to yield 30% overshoot using Angle Criterion

At this gain value an overshoot of 30% is achieved, shown in Figure 3. The Settling time at this gain value is 3.922 seconds. This must now be reduced to 1.961 seconds. Using Equation 3 we can judiciously place the poles and zeros of the controller in order to reduce the settling time.

$$\sigma = \frac{1}{T_s} \ln(50) \quad (3)$$

Equation 3 yields a value of -1.9949. Thus we must place our pole and zero beyond this point on our root locus.

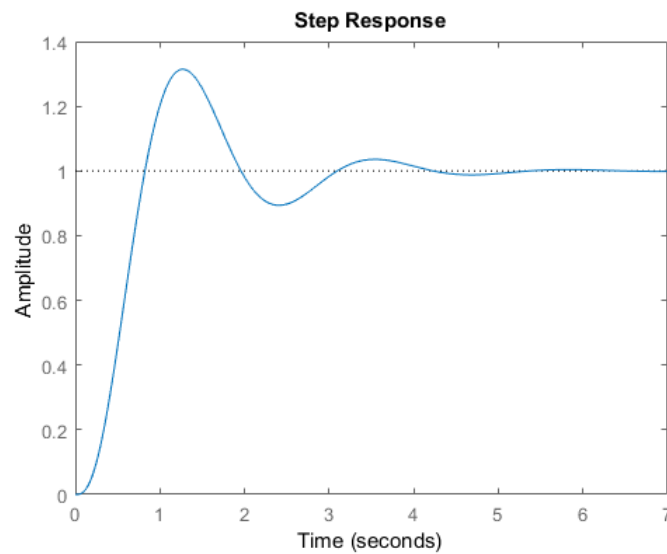


Figure 3: Step Response of System with 30% Overshoot

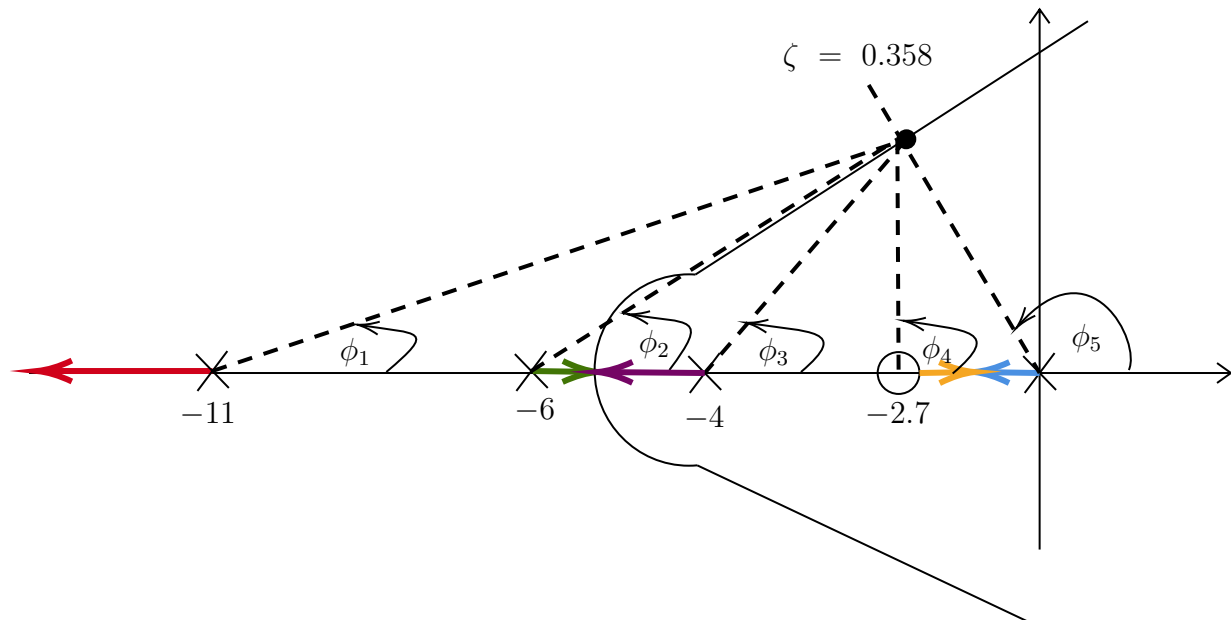


Figure 4: Intersection with Compensated Root Locus to determine gain for Reduction in Settling Time

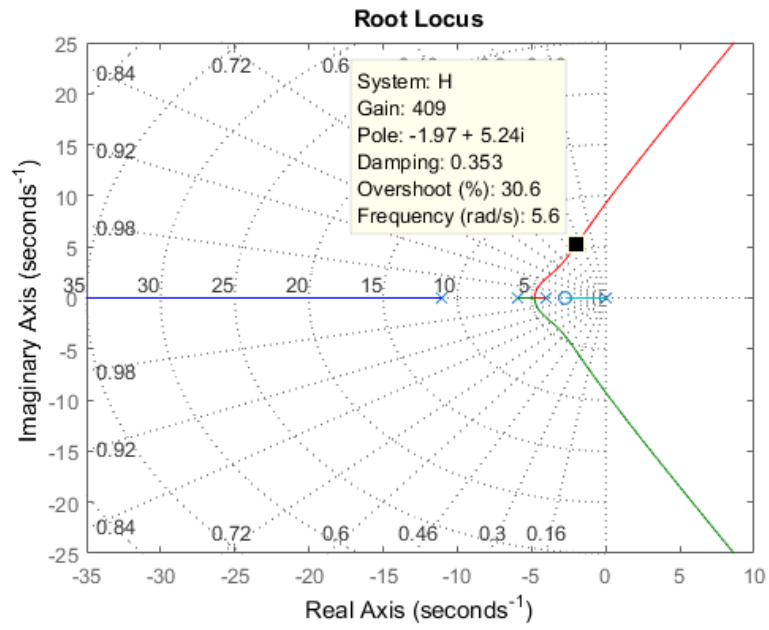


Figure 5: Matlab Root Locus of Compensated System

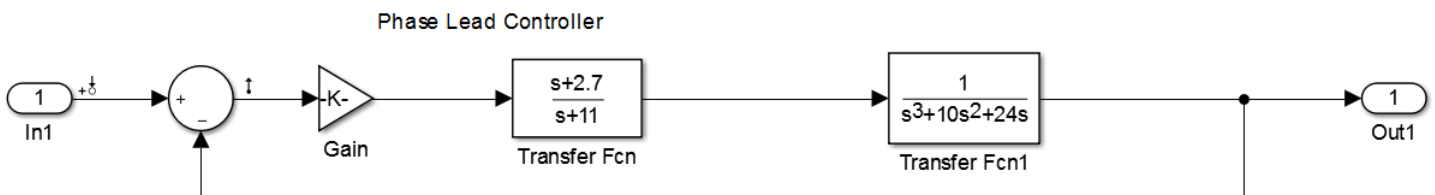


Figure 6: Closed Loop Diagram of Plant with Controller

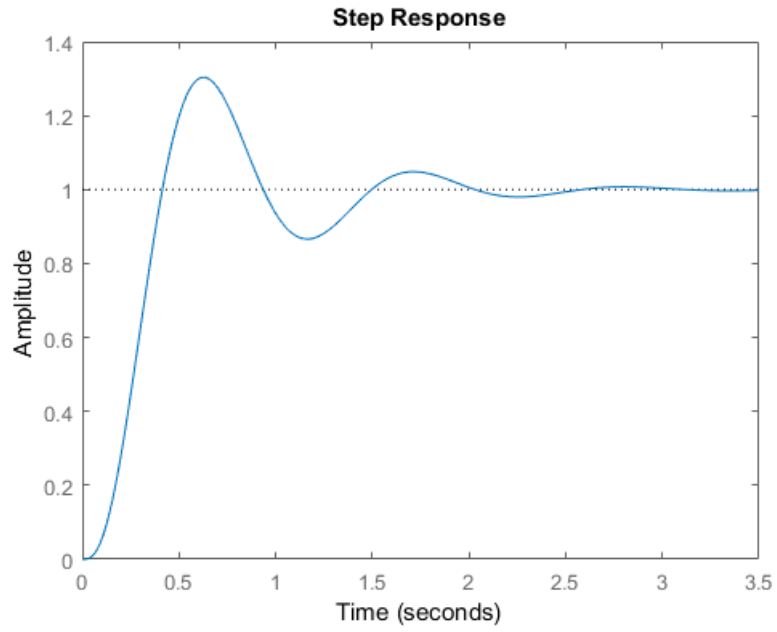


Figure 7: Step Response of Compensated System with Controller

Table 1: Matlab Simulated Characteristics

Property	
Rise Time (s)	0.2528
Settling Time (s)	1.9275
Overshoot (%)	30.3637
Peak Amplitude	1.3036