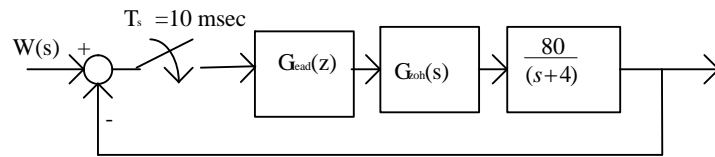


1. Consider the following system:



- a) Design a lead compensator, $G_{lead}(z)$, which meets the following specs:
- $ess|_{ramp} = 1/50$
 - gain margin > 5 dB
 - phase margin $> 30^\circ$
2. a) Repeat problem 1 using lag compensation techniques
- b) Find the step response and the closed-loop Bode plot for both of your designs. What is the bandwidth of each closed-loop compensated system?
- c) Suppose our input is corrupted by periodic additive noise such that the actual input is $w(t) + 2.5\cos 20t$. For both closed-loop systems, find the magnitude of the noise at the output (i.e., the magnitude of $y|_{2.5\cos 20t}$). (Hint: use your closed-loop Bode plot from part b)). Which system does a better job at attenuating the effects of the noise?