# EECS 128 Introduction to Control Design Techniques
# Problem Set 5

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**Problem 1.** Consider the open loop transfer functions

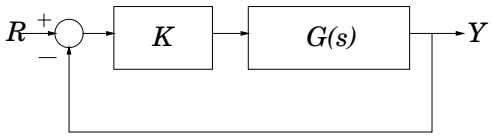


Figure 1: Unity Feedback System.

$$(i)\ G(s) = \frac{s+2}{s+10};\ \ (ii)\ G(s) = \frac{100(s/10+1)}{s(s-1)(s/100+1)}$$

For each of the above cases, plot the Nyquist diagram with respect to the closed loop system shown in Figure 1, and determine the range of $K$ for which the closed loop system is stable.

**Problem 2.** Suppose

$$G(s) = \frac{1}{s^4(s+1)}$$

and $K = 1$. Is the system shown in Figure 1 stable?

**Problem 3.** Your friend from Stanford tells you that with a simple application of Cauchy's Principle you can determine whether or not the closed loop system of Figure 1 has poles *to the left* of $s = -a$, where $a > 0$ is a real number. Describe this application, and use it to determine whether or not the system $G(s) = 1/s$, when put in the unity feedback systems of Figure 1, has a closed loop pole to the left of $s = -2$ for $K = 1$.