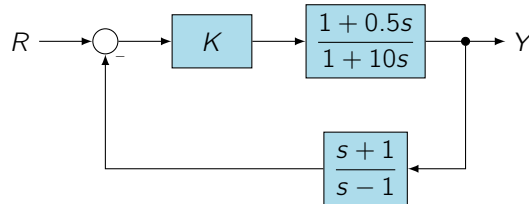


Control Systems : Set 6 : Loopshaping (2)

Prob 1 | Use Matlab to draw the Nyquist plot for the system below. Determine the range of K for which the system is stable using the plot.



Note: In class we consider the loop-gain to be $K \cdot G$, but here we also have the dynamics of the sensor $\frac{s+1}{s-1}$ to consider. To decide what we should be plotting for our Nyquist diagram, we have to consider what the closed-loop system will be. Define $G = \frac{1+0.5s}{1+10s}$ and $H = \frac{s+1}{s-1}$, then transfer function from R to Y is

$$Y = GK(R - HY)$$

$$Y(1 + KGH) = GKR$$

$$\frac{Y}{R} = \frac{KG}{1 + KGH}$$

The Nyquist criterion is then asking the question: Does $1 + KGH$ have any zeros in the right-half plane? So to answer this question we plot the Nyquist plot of $L = KGH$ and test loop at how many encirclements we have of -1 .

Prob 2 | Use Matlab to draw the Nyquist plot for

$$G(s) = \frac{K(s+1)}{s(s+3)}$$

and determine the range of K for which the system is stable using the Nyquist criterion.