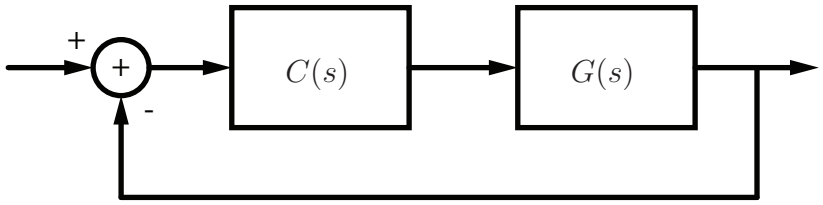
University of Toronto
Department of Electrical and Computer Engineering
ECE311 Dynamic Systems and Control
Homework 5

Nyquist Stability Criterion

1. For each of the following cases, using the Nyquist criterion determine if the feedback loop below is BIBO stable.



(a)

$$\begin{aligned} G(s) &= \frac{50}{s(s+3)(s+6)} \\ C(s) &= 1\,. \end{aligned}$$

(b)

$$\begin{aligned} G(s) &= \frac{1}{s(s+1)} \\ C(s) &= s+4\,. \end{aligned}$$

(c)

$$\begin{aligned} G(s) &= \frac{20}{s(s+1)} \\ C(s) &= \frac{(s+3)}{(s+4)}\,. \end{aligned}$$

(d)

$$\begin{aligned} G(s) &= \frac{100(s+5)}{s(s+3)(s^2+4)} \\ C(s) &= 1\,. \end{aligned}$$

2. Referring to the feedback loop above, find the range of K for stability in each case below.

(a)

$$\begin{aligned} G(s) &= \frac{K}{(s+2)} \\ C(s) &= \frac{1}{(s+4)(s+6)}\,. \end{aligned}$$

(b)

$$\begin{aligned} G(s) &= \frac{K(s^2-4s+13)}{(s+2)(s+4)} \\ C(s) &= \frac{1}{s}\,. \end{aligned}$$

(c)

$$\begin{aligned} G(s) &= \frac{K(s-1)}{(s+1)} \\ C(s) &= \frac{(s-2)}{(s+2)}\,. \end{aligned}$$