

# ECE311S: Dynamic Systems and Control

## Problem Set 8

### Problem 1

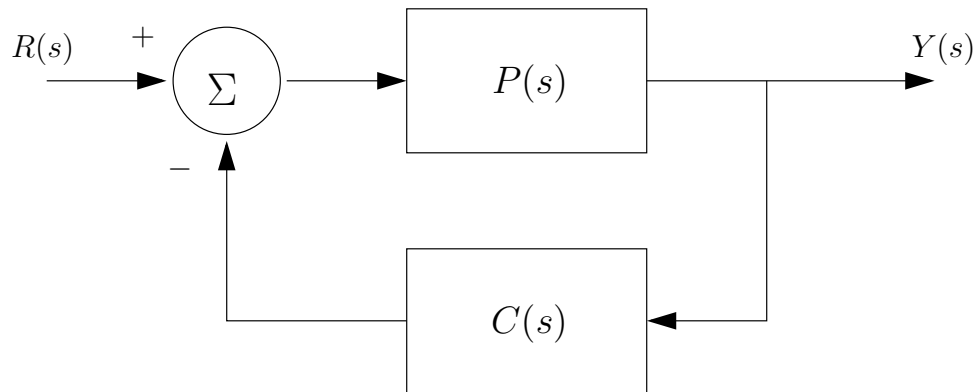


Figure 1: Feedback system for Problem 1

1. Sketch the Nyquist diagram for each of the following systems.
2. For each system, use the Nyquist criterion to determine if the system is stable.

(a)

$$P(s) = \frac{50}{s(s+3)(s+6)}$$
$$C(s) = 1.$$

(b)

$$P(s) = \frac{1}{s(s+1)}$$
$$C(s) = s+4.$$

(c)

$$P(s) = \frac{20}{s(s+1)}$$
$$C(s) = \frac{(s+3)}{(s+4)}.$$

(d)

$$P(s) = \frac{100(s+5)}{s(s+3)(s^2+4)}$$
$$C(s) = 1.$$

## Problem 2

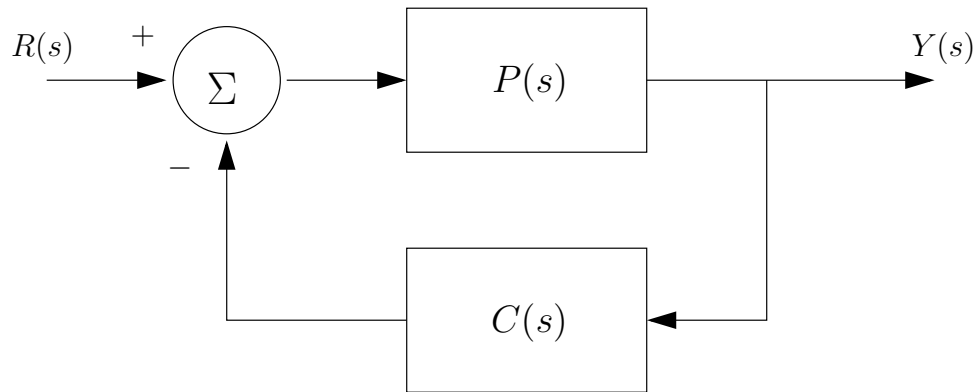


Figure 2: Feedback system for Problem 2

For each system, find the range of  $K$  for stability.

(a)

$$P(s) = \frac{K}{(s+2)}$$
$$C(s) = \frac{1}{(s+4)(s+6)}.$$

(b)

$$P(s) = \frac{K(s^2 - 4s + 13)}{(s+2)(s+4)}$$
$$C(s) = \frac{1}{s}.$$

(c)

$$P(s) = \frac{K(s-1)}{(s+1)}$$
$$C(s) = \frac{(s-2)}{(s+2)}.$$