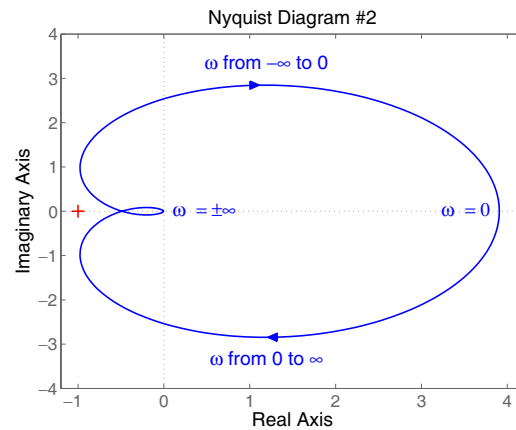
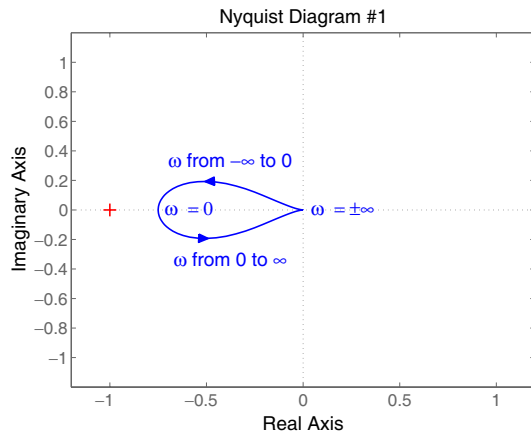


ELEC ENG 4CL4 – Control System Design

Homework Assignment #3

Submission deadline: 12 noon on Friday, March 5, 2004, in the designated drop box in CRL-101B (the CRL photocopying room).

1. Consider the following two Nyquist diagrams labelled #1 and #2:



For each of these Nyquist diagrams, what can you say about:

- a. the *open-loop stability* of the plant and controller, and
- b. the *closed-loop stability* of the plant and controller? **(20 pts)**

2. Determine the PID controller parameters (for the *standard form*) for a plant with the nominal model:

$$G_o(s) = \frac{2}{(s+2)(s+1)^2},$$

using the Ziegler-Nichols oscillation method. **(30 pts)**

3. Find suitable PID controller parameters (for the *standard form*) for a plant with the nominal model:

$$G_o(s) = \frac{10}{(s+2)(s+5)}, \tag{1}$$

using the reaction curve method with:

- a. the Ziegler-Nichols parameters, and
- b. the Cohen-Coon parameters. **(30 pts)**

QUESTION 4 ON NEXT PAGE!

4. For the controller and plant with the open-loop Bode diagram shown below,:
- estimate both the *stability gain margin* and the *stability phase margin*, and
 - design a lead compensator $C_{\text{lead}}(s)$ to increase the phase margin.

(20 pts)

