ENGR 105: Feedback Control Design
Winter 2013

Lecture 22 - Nyquist Plot Examples

Wednesday, March 6, 2013

Today's Objectives

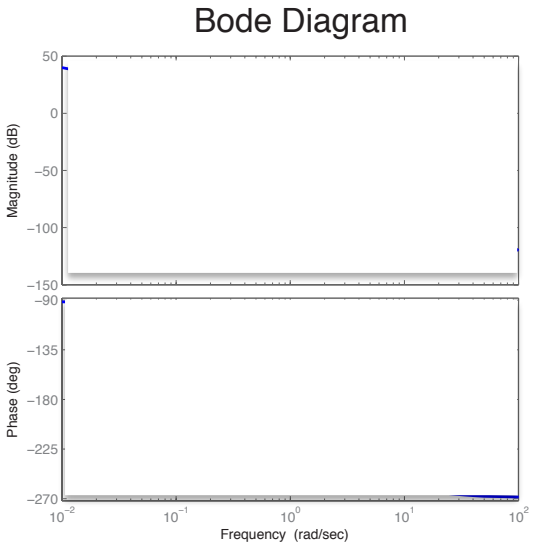
Work through two important examples:

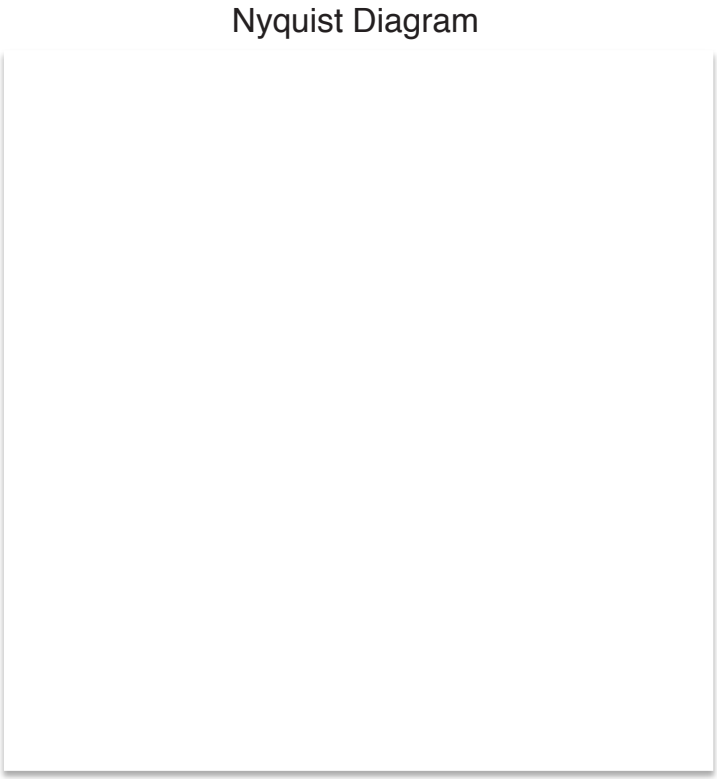
1. Nyquist plot for a system with a pole on the imaginary axis
2. Nyquist plot for an open-loop unstable system

Reading: FPE Sections 6.3, 6.4

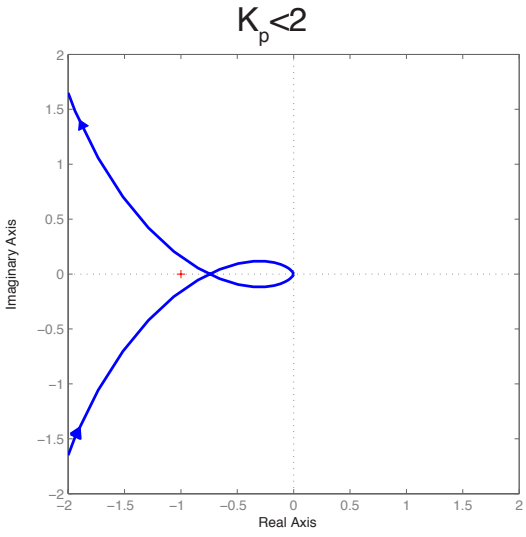
Example: Nyquist plot for a system with a pole on the imaginary axis

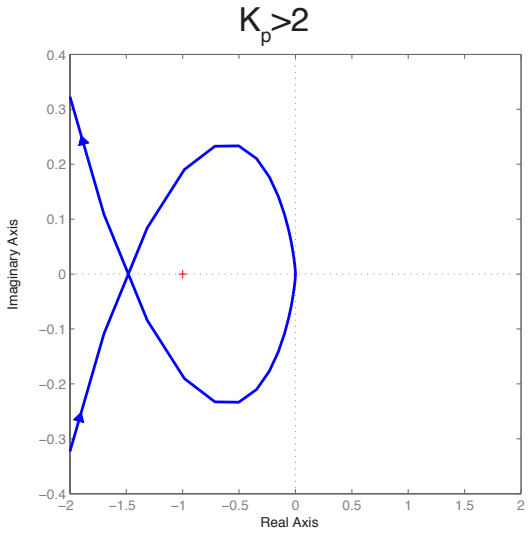
$$G(s) = \frac{1}{s(s+1)^2}$$





Two possible cases:





$N =$
$P =$
# of unstable closed-loop poles =

$N =$
$P =$
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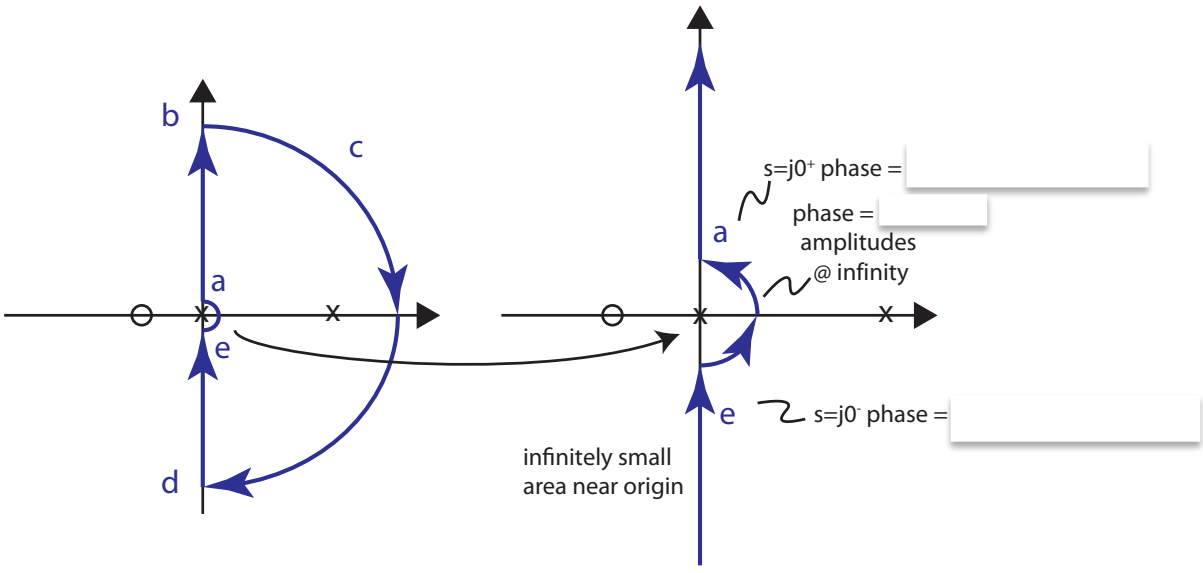
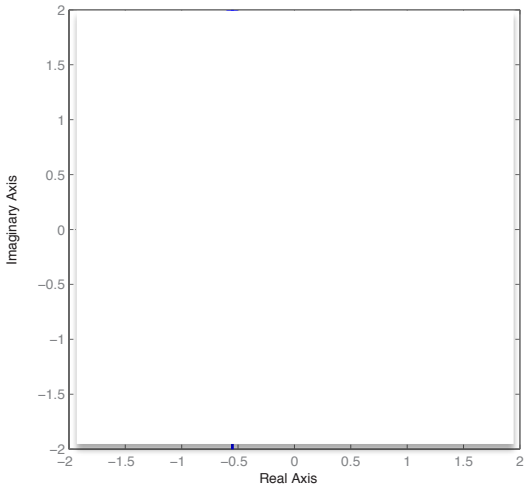
Example: Nyquist plot for an open-loop unstable system

$$G(s) = \frac{(s+1)}{s\left(\frac{s}{10} - 1\right)}$$



Two possible cases:

Low gain

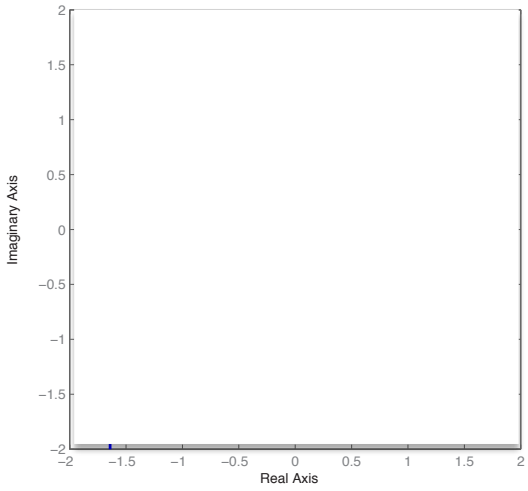


$N =$

$P =$

# of unstable closed-loop poles =

High gain



$N =$

$P =$

# of unstable closed-loop poles =

MATLAB code:

```
sys = tf([1],[1 2 1 0]) % example 1
sys = tf([1 1],[0.1 -1 0]); % example 2
rlocus(sys)
figure
bode(sys); grid on
figure
nyquist(sys)
```

Some other useful Matlab commands:

```
s = tf('s');
sys = 1/(s*(s+1)^2);
margin(sys);
allmargin(sys);
```