16.06 Lecture 37
Bode Design

Karen Willcox

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Today's Topics

1. Gain and phase margin

2. More Bode Examples

Reading: 7.6, 7.7

1 Gain and Phase Margin

Recall the definition of gain margin and phase margin we saw with Nyquist plots:

Now consider the translation of these concepts to the Bode diagram. We note the following:

- The crossover frequency, ω_c, is the frequency where

- Phase margin, $\phi_m =$

- Gain margin, $GM =$

- Gain margin in dB, $GM_{dB} =$

On a Bode diagram:

1. ω_c is the frequency where

2. ϕ_m is

3. GM_{dB} is

Note: Bode digrams do not show the encirclements specified by the Nyquist criterion. Therefore, Bode plot stability analysis is limited to open-loop stable systems. Root locus or Nyquist diagrams should be used for open-loop unstable systems.

2 Examples

The phase and gain margins can be calculated from either a Bode diagram, or from tabulated Bode data.

Example 1:

Insert Matlab figure here

Example 2:

Insert tabulated data here.

Do calculation in log units and in dB.

Example 3:

$$G(s) = \frac{100(0.1s + 1)}{s(s + 1)}$$

Example 4:

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