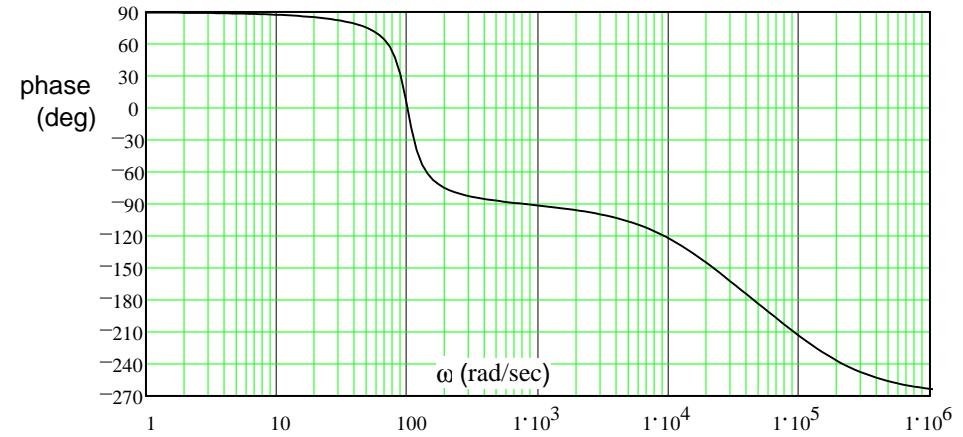
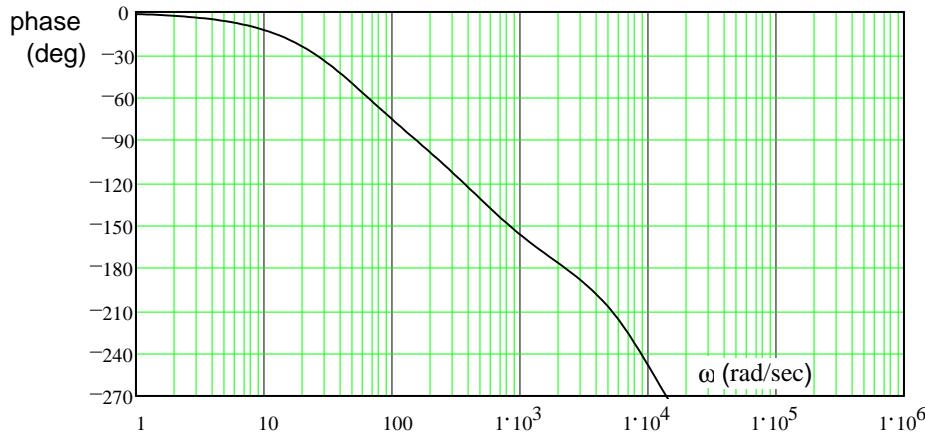
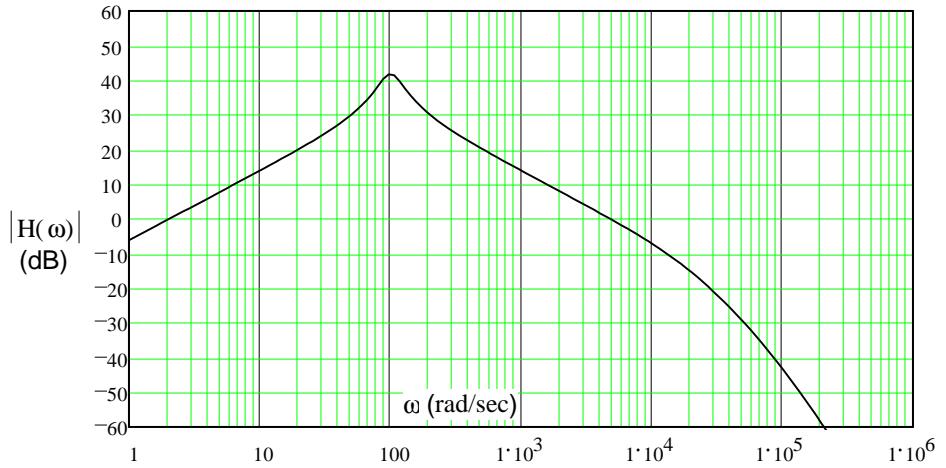
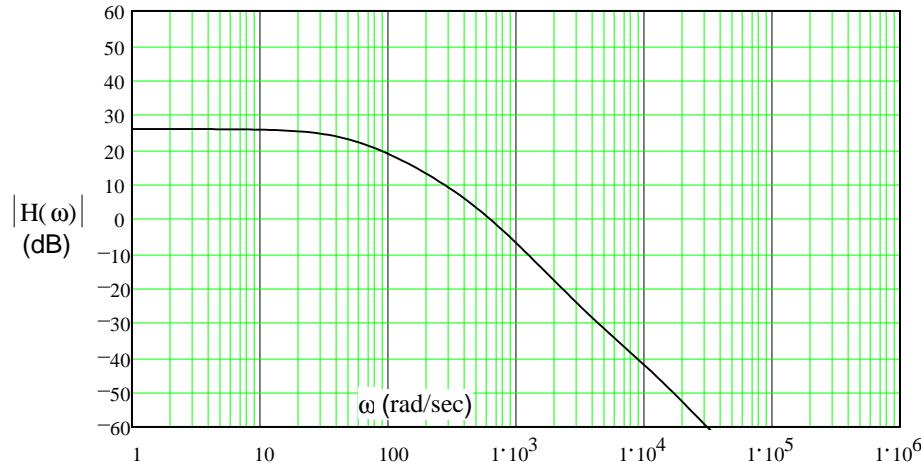


ECE 3510 Gain, Phase, and Delay margins

A. Stolp
4/8/14



Gain Margin $GM := 20 \cdot \text{dB}$ At about: $2200 \cdot \frac{\text{rad}}{\text{sec}}$

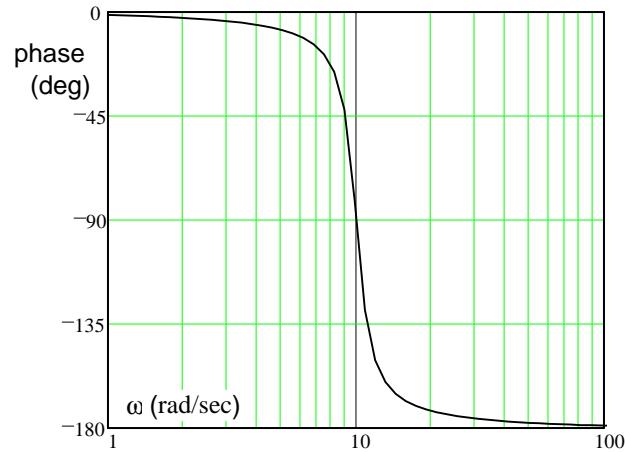
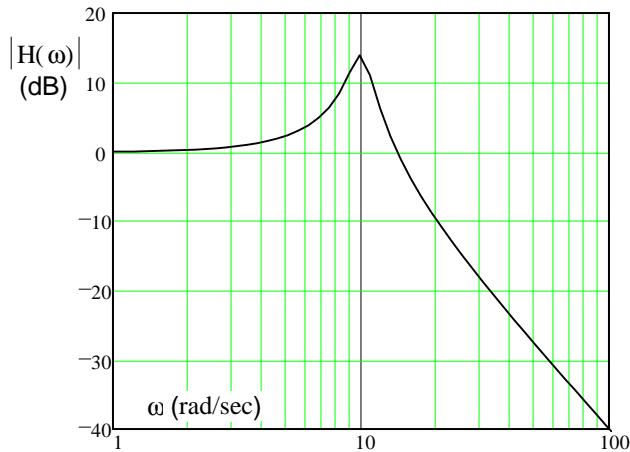
Gain Margin $GM := 27 \cdot \text{dB}$ occurs at about: $43000 \cdot \frac{\text{rad}}{\text{sec}}$

Phase Margin $PM_a := 40 \cdot \text{deg}$ At about: $\omega_{PMa} := 620 \cdot \frac{\text{rad}}{\text{sec}}$

Phase Margin $PM_b := 180 \cdot \text{deg} - 105 \cdot \text{deg}$
 $PM_b = 75 \cdot \text{deg}$ occurs at about: $\omega_{PMb} := 5800 \cdot \frac{\text{rad}}{\text{sec}}$

Delay Margin $f_1 := \frac{\omega_{PMa}}{2 \cdot \pi}$ $T_a := \frac{2 \cdot \pi}{\omega_{PMa}}$
 $DM_a := \left(\frac{40 \cdot \text{deg}}{360 \cdot \text{deg}} \right) \cdot T_a$ $DM_a = 1.126 \cdot \text{ms}$

Delay Margin $f_b := \frac{\omega_{PMb}}{2 \cdot \pi}$ $T_b := \frac{2 \cdot \pi}{\omega_{PMb}}$ $DM_b := \left(\frac{75 \cdot \text{deg}}{360 \cdot \text{deg}} \right) \cdot T_b$
 $DM_b = 0.226 \cdot \text{ms}$



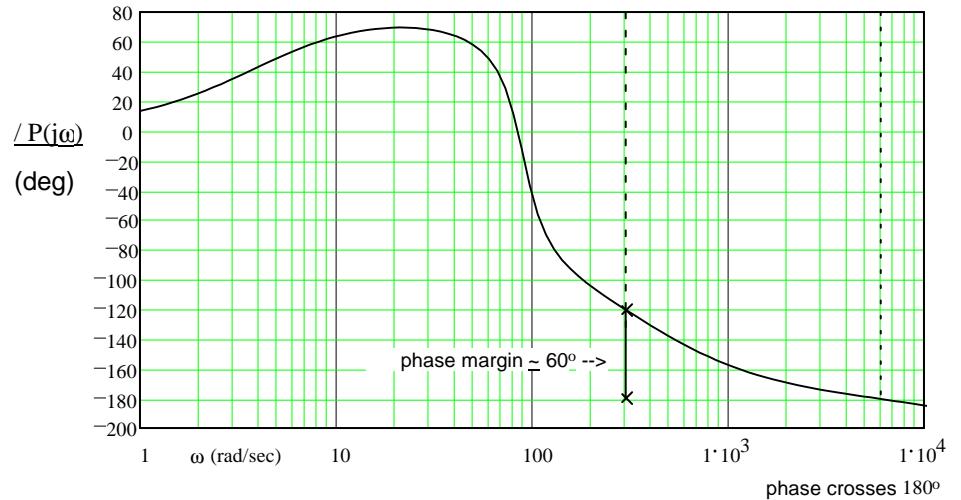
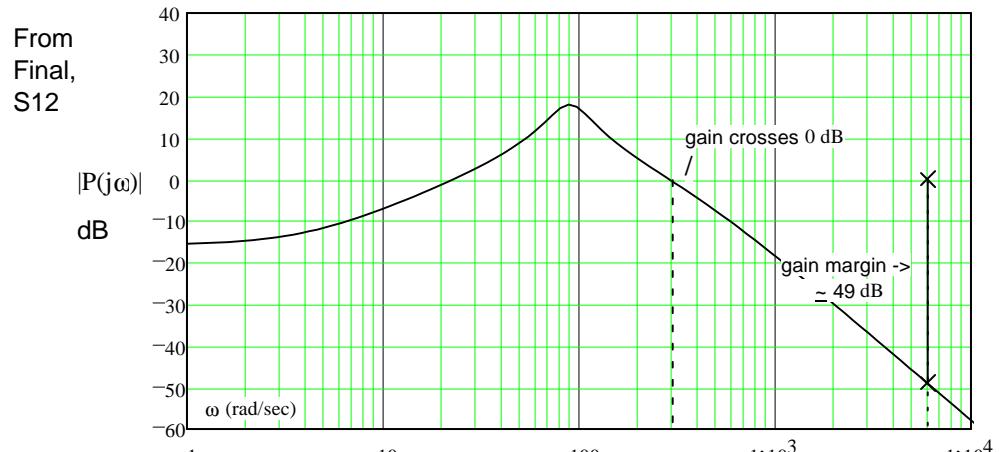
Gain Margin Doesn't apply

Phase Margin $PM_c := 180 \cdot \text{deg} - 162 \cdot \text{deg}$

$$PM_c = 18 \cdot \text{deg}$$

occurs at about: $\omega_{PMc} := 13 \cdot \frac{\text{rad}}{\text{sec}}$

Delay Margin $f_c := \frac{\omega_{PMc}}{2 \cdot \pi}$ $T_c := \frac{2 \cdot \pi}{\omega_{PMc}}$ $DM_c := \left(\frac{18 \cdot \text{deg}}{360 \cdot \text{deg}} \right) \cdot T_c$
 $DM_c = 24 \cdot \text{ms}$



Gain Margin $GM := 49 \cdot \text{dB}$

Phase Margin $180 - 120 = 60$

$PM_d := 60 \cdot \text{deg}$
occurs at about: $300 \cdot \frac{\text{rad}}{\text{sec}}$

Delay Margin $f_d := \frac{300}{2 \cdot \pi}$ $T_d := \frac{2 \cdot \pi}{300 \cdot \frac{\text{rad}}{\text{sec}}}$ $T_d = 0.021 \cdot \text{sec}$
 $DM_d := \left(\frac{60 \cdot \text{deg}}{360 \cdot \text{deg}} \right) \cdot T_d$ $DM_d = 3.49 \cdot \text{ms}$