MECH 467 - Tutorial 8 - Stability Margins

Given the following 3rd order system:

$$G(s) = \frac{28900}{s(s^2 + 240s + 28900)}$$

1) Sketch the bode plot of the system and compare the bode plot against the result using the MATLAB command.

2) Calculate the gain margin and phase margin of the plant system. Compare with MATLAB. If a proportional controller is designed, calculate the proportional gain which makes the system critically stable.

3) Design the proportional controller such that the gain cross over frequency is 60 rad/s.

4) Given two proportional gains K_P = 100 and K_P = 500, obtain the Nyquist plot of the system for each K_P value, evaluate the system stability based on the Nyquist diagram. Plot the root locus using MATLAB and evaluate the stability for K_P = 100 and K_P = 500.