Problem 1: A unity-feedback system has a loop transfer function given by

\[ L(s) = \frac{K}{s(0.5s + 1)} \]

(a) For a unit-step input, the closed-loop response must have a peak overshoot of 16%. Determine the required value of \(K\).

(b) If \(K = 2\), what is the approximate rise time of the output response to a step input?

(c) If \(K = 2\) and the input is a unit ramp, what is the steady-state error?

Problem 2: Consider the following loop transfer functions:

\[ L_1(s) = \frac{10^6}{s} \quad L_2(s) = \frac{10^6}{s + 1} \quad L_3(s) = \frac{10^{10}(10^{-4}s + 1)}{s^2} \quad L_4(s) = \frac{10^6(10^{-4}s + 1)}{(10^{-2}s + 1)^2} \]

For each loop transfer function:

(a) Find the DC gain and the unity-gain frequency.

(b) Plot an asymptotic Bode Plot.

(c) Find the error transfer function, assuming that the above loop transfer functions describe op-amp circuits with unity feedback.

(d) Find the steady state error to a 1 V step input.

(e) Find the steady state error to a 1 V/s ramp input.

Problem 3: A linear system may be stable for certain inputs and unstable for other inputs. True or false?

Problem 4: The following loop transfer function is used in a unity-feedback system

\[ L(s) = \frac{K}{(s + 1)(s^2 + s + 1)} \]

For what values of \(K\) is the system stable?
Problem 5: The following loop transfer function is used in a unity-feedback system

\[ L(s) = \frac{K}{(s + 1)^2(s^2 + s + 1)} \]

For what values of \( K \) is the system stable?