

10.80 An op amp designed to have a low-frequency gain of 10^5 and a high-frequency response dominated by a single pole at 100 rad/s, acquires, through a manufacturing error, a pair of additional poles at 10,000 rad/s. At what frequency does the total phase shift reach 180° ? At this frequency, for what value of β , assumed to be frequency independent, does the loop gain reach a value of unity? What is the corresponding value of closed-loop gain at low frequencies?

10.83 Consider a feedback amplifier for which the open-loop gain $A(s)$ is given by

$$A(s) = \frac{1000}{(1 + s/10^4)(1 + s/10^5)^2}$$

If the feedback factor β is independent of frequency, find the frequency at which the phase shift is 180° , and find the critical value of β at which oscillation will commence.

10.88 Three identical inverting amplifier stages each characterized by a low-frequency gain K and a single-pole response with $f_{3\text{dB}} = 100$ kHz are connected in a feedback loop with $\beta = 1$. What is the minimum value of K at which the circuit oscillates? What would the frequency of oscillation be?

10.92 An amplifier has a dc gain of 10^5 and poles at 10^5 Hz, 3.16×10^5 Hz, and 10^6 Hz. Find the value of β , and the corresponding closed-loop gain, for which a phase margin of 45° is obtained.

D 10.95 A multipole amplifier having a first pole at 3 MHz and a dc open-loop gain of 60 dB is to be compensated for closed-loop gains as low as unity by the introduction of a new dominant pole. At what frequency must the new pole be placed?

D 10.96 For the amplifier described in Problem 10.95, rather than introducing a new dominant pole we can use additional capacitance at the circuit node at which the pole is formed to reduce the frequency of the first pole. If the frequency of the second pole is 15 MHz and if it remains unchanged while additional capacitance is introduced as mentioned, find the frequency to which the first pole must be lowered so that the resulting amplifier is stable for closed-loop gains as low as unity. By what factor is the capacitance at the controlling node increased?

D 10.98 An op amp with open-loop voltage gain of 10^4 and poles at 10^6 Hz, 10^7 Hz, and 10^8 Hz is to be compensated by the addition of a fourth dominant pole to operate stably with unity feedback ($\beta = 1$). What is the frequency of the required dominant pole? The compensation network is to consist of an RC low-pass network placed in the negative-feedback path of the op amp. The dc bias conditions are such that a $1\text{-M}\Omega$ resistor can be tolerated in series with each of the negative and positive input terminals. What capacitor is required between the negative input and ground to implement the required fourth pole?