2.110 Measurements made on the internally compensated amplifiers listed below provide the dc gain and the frequency at which the gain has dropped by 20 dB. For each, what are the 3 dB and unity-gain frequencies?

(a) 2×10^5 V/V and 5×10^2 Hz
(b) 20×10^5 V/V and 10 Hz
(c) 1800 V/V and 0.1 MHz
(d) 100 V/V and 0.1 GHz
(e) 25 V/mV and 250 kHz

2.111 An inverting amplifier with nominal gain of −50 V/V employs an op amp having a dc gain of 10^4 and a unity-gain frequency of 10^6 Hz. What is the 3-dB frequency f_{3dB} of the closed-loop amplifier? What is its gain at $0.1 f_{3dB}$ and at $10 f_{3dB}$?

D *2.117 This problem illustrates the use of cascaded closed-loop amplifiers to obtain an overall bandwidth greater than can be achieved using a single-stage amplifier with the same overall gain.

(a) Show that cascading two identical amplifier stages, each having a low-pass STC frequency response with a 3-dB frequency f_1, results in an overall amplifier with a 3-dB frequency given by

$$f_{3\text{dB}} = \sqrt{\sqrt{2}-1}\, f_1$$

(b) It is required to design a noninverting amplifier with a dc gain of 40 dB utilizing a single internally compensated op amp with $f_t = 2$ MHz. What is the 3-dB frequency obtained?

(c) Redesign the amplifier of (b) by cascading two identical noninverting amplifiers each with a dc gain of 20 dB. What is the 3-dB frequency of the overall amplifier? Compare this to the value obtained in (b) above.

2.124 For operation with 10-V output pulses with the requirement that the sum of the rise and fall times represent only 20% of the pulse width (at half-amplitude), what is the slew-rate requirement for an op amp to handle pulses 2 μs wide? (*Note:* The rise and fall times of a pulse signal are usually measured between the 10%- and 90%-height points.)

2.126 For an amplifier having a slew rate of 40 V/μs, what is the highest frequency at which a 20-V peak-to-peak sine wave can be produced at the output?