EXERCISE

8.7 Use the feedback method to find the voltage gain V_o/V_s, the input resistance R_{in}, and the output resistance R_{out} of the inverting op-amp configuration of Fig. E8.7. Let the op amp have open-loop gain $\mu = 10^4$ V/V, $R_{id} = 100$ kΩ, and $r_o = 1$ kΩ. (*Hint:* The feedback is of the shunt–shunt type.)

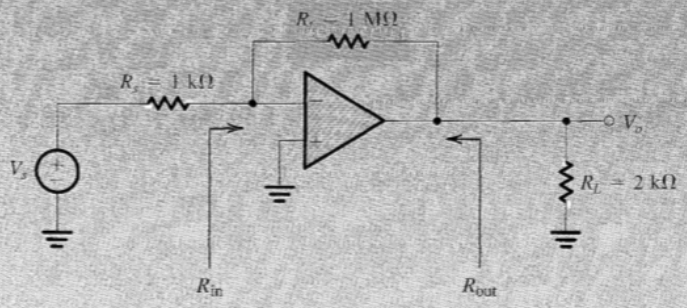

FIGURE E8.7

Ans. −870 V/V; 150 Ω; 92 Ω

EXERCISE

8.11 An op amp having a single-pole rolloff at 100 Hz and a low-frequency gain of 10^5 is operated in a feedback loop with $\beta = 0.01$. What is the factor by which feedback shifts the pole? To what frequency? If β is changed to a value that results in a closed-loop gain of +1, to what frequency does the pole shift?

Ans. 1001; 100.1 kHz; 10 MHz

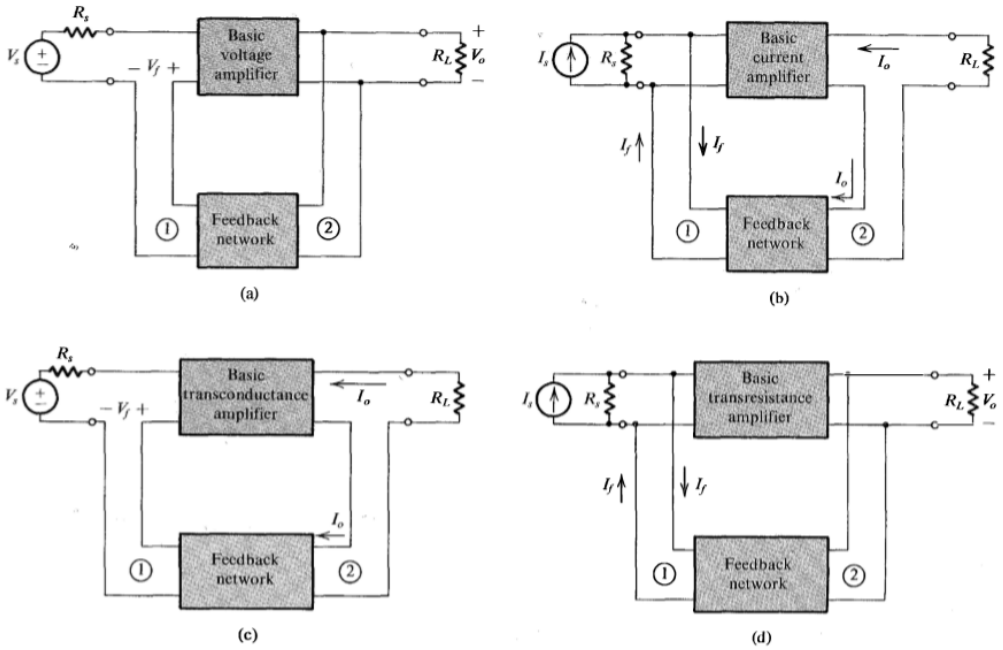

FIGURE 8.4 The four basic feedback topologies: **(a)** voltage-mixing voltage-sampling (series–shunt) topology; **(b)** current-mixing current-sampling (shunt–series) topology; **(c)** voltage-mixing current-sampling (series–series) topology; **(d)** current-mixing voltage-sampling (shunt–shunt) topology.

8.21 A series–shunt feedback amplifier representable by Fig. 8.4(a) and using an ideal basic voltage amplifier operates with $V_s = 100$ mV, $V_f = 95$ mV, and $V_o = 10$ V. What are the corresponding values of A and β? Include the correct units for each.

8.22 A shunt–series feedback amplifier representable by Fig. 8.4(b) and using an ideal basic current amplifier operates with $I_s = 100\ \mu$A, $I_f = 95\ \mu$A, and $I_o = 10$ mA. What are the corresponding values of A and β? Include the correct units for each:

8.24 A series–series feedback circuit representable by Fig. 8.4(c) and using an ideal transconductance amplifier operates with $V_s = 100$ mV, $V_f = 95$ mV, and $I_o = 10$ mA. What are the corresponding values of A and β? Include the correct units for each.

8.25 A shunt–shunt feedback circuit representable by Fig. 8.4(d) and using an ideal transresistance amplifier operates with $I_s = 100\ \mu$A, $I_f = 95\ \mu$A, and $V_o = 10$ V. What are the corresponding values of A and β? Include the correct units for each.

***8.26** For each of the op-amp circuits shown in Fig. P8.26, identify the feedback topology and indicate the output variable being sampled and the feedback signal. In each case, assuming the op amp to be ideal, find an expression for β, and hence find A_f.

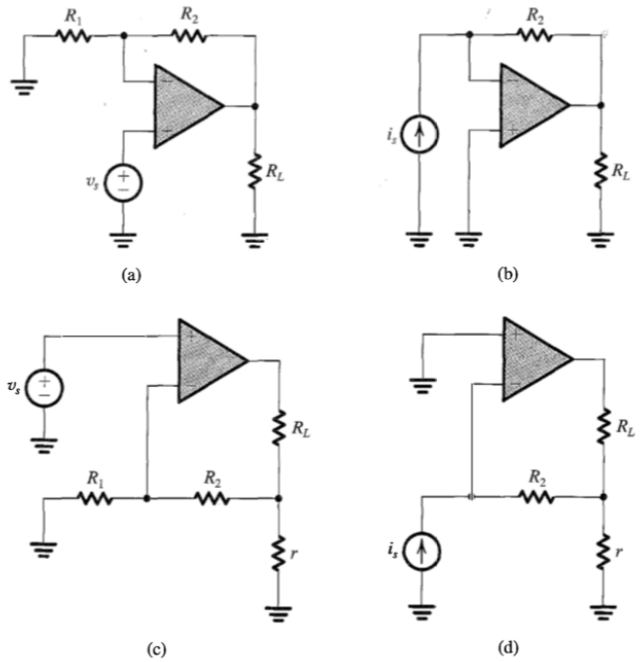

FIGURE P8.26

****8.29** A series–shunt feedback circuit employs a basic voltage amplifier that has a dc gain of 10^4 V/V and an STC frequency response with a unity-gain frequency of 1 MHz. The input resistance of the basic amplifier is 10 kΩ, and its output resistance is 1 kΩ. If the feedback factor $\beta = 0.1$ V/V, find the input impedance Z_{if} and the output impedance Z_{of} of the feedback amplifier. Give equivalent circuit representations of these impedances. Also find the value of each impedance at 10^3 Hz and at 10^5 Hz.

8.43 A transresistance amplifier having an open-circuit "gain" of 100 V/mA, an input resistance of 1 kΩ, and an output resistance of 1 kΩ is connected in a negative-feedback loop employing a shunt–shunt topology. The feedback network has an input resistance (with port 1 short-circuited) of 10 kΩ and an input resistance (with port 2 short-circuited) of 10 kΩ and provides a feedback factor $\beta = 0.1$ mA/V. The amplifier is fed with a current source having $R_s = 10$ kΩ, and a load resistance $R_L = 1$ kΩ is connected at the output. Find the transresistance A_f of the feedback amplifier, its input resistance R_{in}, and its output resistance R_{out}.