19 Dec 2022

EE101 Tutorial 5

Topic: OPERATIONAL AMPLIFIERS

Q1.An op amp exhibits the following nonlinear characteristic:

$$\mathbf{Vout = \alpha \tanh[\beta(Vin1 - Vin2)]}$$

Sketch this characteristic and determine the small-signal gain of the op amp in the vicinity of **Vin1 − Vin2 ≈ 0.**

Q2. Calculate the closed-loop gain of the noninverting amplifier shown in Fig.1 If A0 =∞. Verify that the result reduces to expected values if R1 → 0 or R3 → 0.

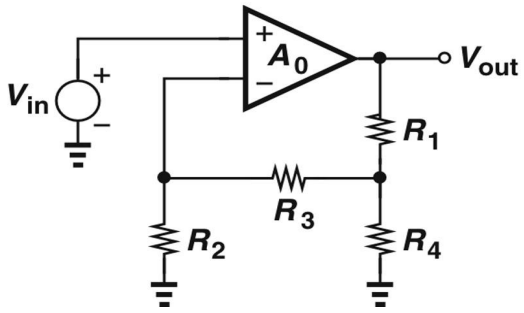

Fig. 1

Q3. The op amp used in an inverting amplifier exhibits a finite input impedance, Rin. Modeling the op amp as shown in Fig.2, determine the closed-loop gain and input impedance.

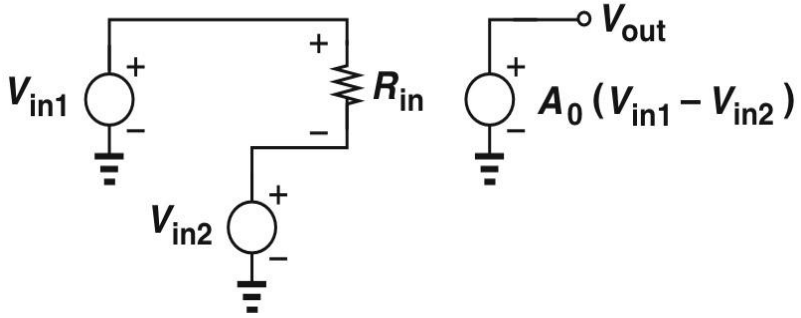

Fig. 2

Q4. Determine the closed-loop gain of the circuit depicted in Fig. 3, if Ao = ∞.

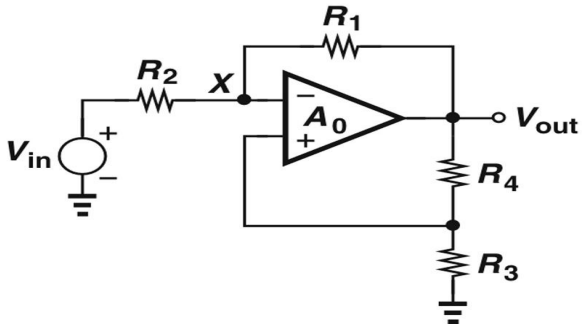

Fig. 3

Q5.The integrator of Fig. 4 senses an input signal given by Vin = V0 sin ωt. Determine the output signal amplitude if A0 =∞.

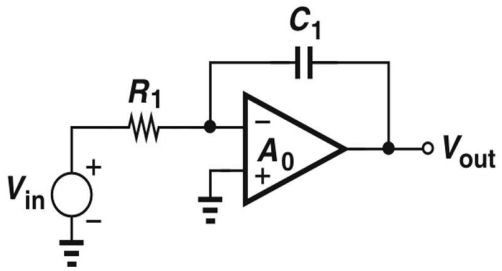

Fig. 4

Q6.The integrator of Fig. 4 is used to amplify a sinusoidal input by a factor of 10. If A0 =∞ and R1C1 = 10 ns, Compute the frequency of the sinusoid.

Q7. Suppose the op amp in Fig. 5 exhibits a finite input impedance and is modeled as

shown in Fig. 2. Determine the transfer function Vout/Vin.

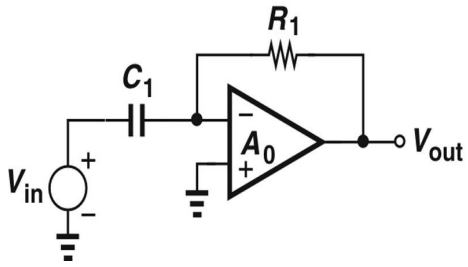

Fig. 5

Q8. Calculate the transfer function of the circuit shown in Fig. 6 if A0 =∞. What choice of component values reduces |Vout/Vin| to unity at all frequencies?

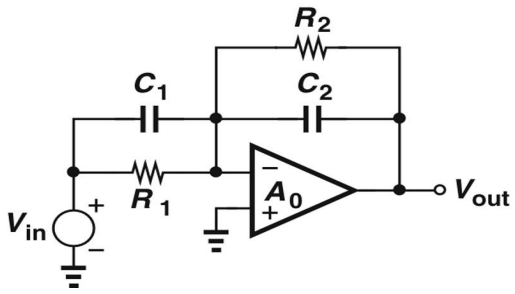

Fig. 6

Q9.Consider the voltage adder shown in Fig. 7. Plot Vout as a function of time if V1 = V0 sin ωt and V2 = V0 sin(3ωt). Assume R1 = R2 and A0 =∞.

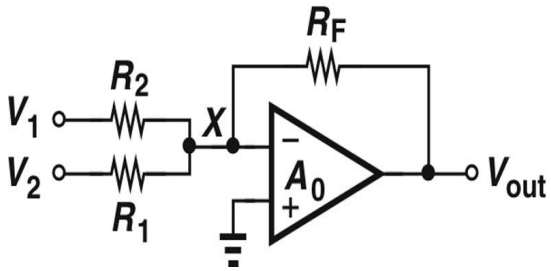

Fig. 7

Q10. Fig. 8 shows a precision rectifier producing negative cycles. Plot V_Y, V_{out} , and the current flowing through D1 as a function of time for a sinusoidal input.

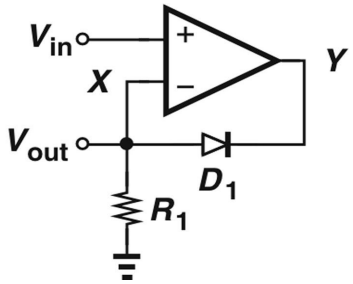

Fig. 8