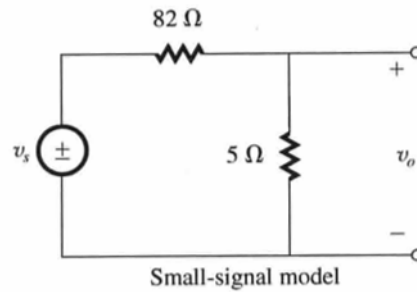


4.59



From the small-signal model

$$\frac{\Delta v_O}{\Delta v_S} = \frac{5}{5 + 82} = \frac{5}{87}$$

Now $\Delta v_S = 1.0 \text{ V}$

$$\begin{aligned} \therefore \Delta V_O &= \frac{5}{87} \Delta V_S = \frac{5}{87} \times 1.0 \\ &= 57.5 \text{ mV} \end{aligned}$$

4.60

$$V_z = V_{z0} + r_z I_{zT}$$

$$9.1 = V_{z0} + 5 \times 28 \times 10^{-3}$$

$$V_{z0} = 8.96 \text{ V}$$

$$V_z = V_{z0} + 5I_z = 8.96 + 5I_z$$

$$\text{For } I_z = 10 \text{ mA} \quad V_z = 9.01 \text{ V}$$

$$\text{For } I_z = 100 \text{ mA} \quad V_z = 9.46 \text{ V}$$