

Problem 9.44 Show that the transfer function of the circuit shown in Fig. P9.44 is given by

$$\mathbf{H}(\omega) = \frac{\mathbf{V}_o}{\mathbf{V}_s} = -G \left(1 + j \frac{\omega}{\omega_c} \right),$$

and relate G and ω_c to R_1 , R_2 , and C .

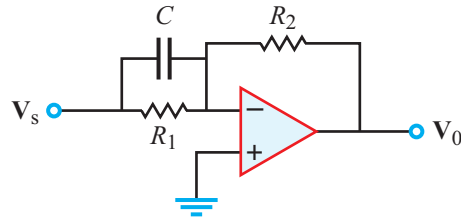


Figure P9.44: Circuit for Problem 9.44.

Solution:

$$\begin{aligned} \mathbf{H}(\omega) = \frac{\mathbf{V}_o}{\mathbf{V}_s} &= \frac{-R_2}{R_1 \parallel (-j/\omega C)} \\ &= -\frac{R_2}{-jR_1/\omega C} \times \left(R_1 - \frac{j}{\omega C} \right) \\ &= -\frac{R_2}{R_1} (1 + j\omega R_1 C) \\ &= -G \left(1 + j \frac{\omega}{\omega_c} \right) \end{aligned}$$

with

$$G = \frac{R_2}{R_1}, \quad \omega_c = \frac{1}{R_1 C}.$$