14.56 For the network in Fig. P14.56, choose the value of C for critical damping.

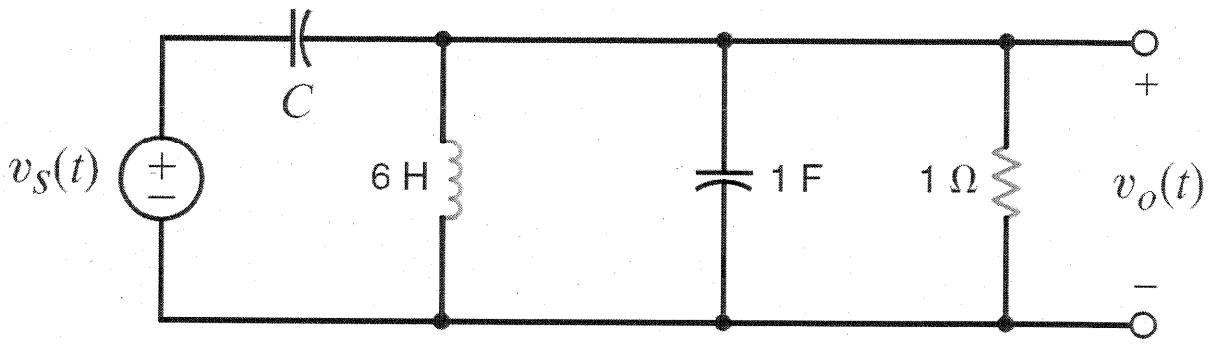
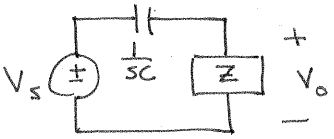


Figure P14.56

SOLUTION:



$$H(s) = \frac{V_o}{V_s} = \frac{Z}{Z + \frac{1}{sC}} \qquad \frac{1}{Z} = \frac{1}{6s} + s + 1 = \frac{6s^2 + 6s + 1}{6s}$$

$$H(s) = \frac{C6s^2}{6Cs^2 + 6s^2 + 6s + 1} = \frac{6Cs^2}{6(C+1)s^2 + 6s + 1}$$

$$H(s) = \frac{\left(\frac{C}{C+1}\right)s}{s^2 + \frac{s}{C+1} + \frac{1}{6(C+1)}}$$

$$\omega_o = \frac{1}{\sqrt{6(C+1)}} \qquad \zeta = 1$$

$$2\zeta\omega_o = \frac{1}{C+1} = \frac{2}{\sqrt{6(C+1)}}$$

$$\sqrt{C+1} = \sqrt{6}/2 \Rightarrow \boxed{C = 0.5\,F}$$