11–3 Find the driving point impedance seen by the voltage source in Figure P11–3 and the voltage transfer function $T_V(s) = V_2(s)/V_1(s)$.

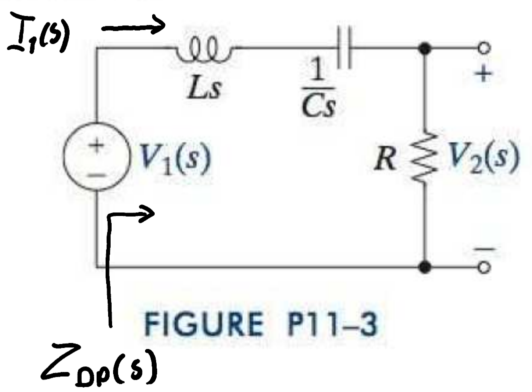

FIGURE P11–3

$$Z_{DP}(s) = \frac{V_1(s)}{I_1(s)}$$

$$T_V(s) = \frac{V_2(s)}{V_1(s)}$$

$$I_1(s) = \frac{V_1(s)}{sL + \frac{1}{sC} + R} = \frac{V_1(s)\cdot sC}{s^2LC + sRC + 1}$$

$\Downarrow$

$$\underline{\underline{Z_{DP}(s) = \frac{s^2LC + sRC + 1}{sC}}}$$

$$V_2(s) = \frac{V_1(s)\cdot R}{sL + \frac{1}{sC} + R} \Rightarrow T_V(s) = \frac{V_2(s)}{V_1(s)} = \frac{R}{sL + \frac{1}{sC} + R}$$

$\Downarrow$

$$\underline{\underline{T_V(s) = \frac{sRC}{s^2LC + sRC + 1}}}$$

11–7 Find the driving point impedance seen by the voltage source in Figure P11–7 and the voltage transfer function. $T_V(s) = V_2(s)/V_1(s)$.

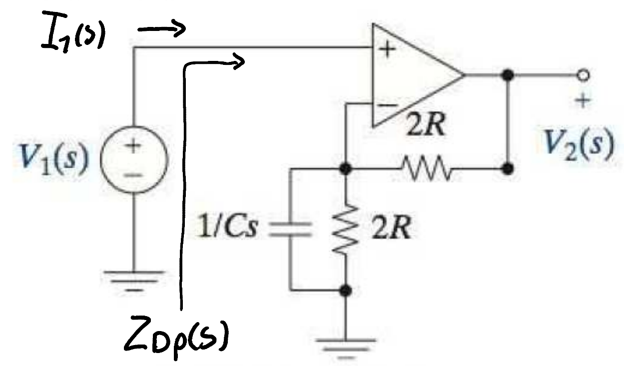

FIGURE P11–7

$$Z_{op}(s) = \frac{V_1(s)}{I_1(s)}$$

$$I_1(s) = 0$$

$$\Downarrow$$

$$\underline{\underline{Z_{op}(s) = \infty}}$$

$$Z_{eq}(s) = 2R // \frac{1}{sC} = \left(\frac{1}{2R} + sC\right)^{-1}$$

$$Z_{eq}(s) = \left(\frac{1}{2R} + \frac{s\,2RC}{2R}\right)^{-1} = \frac{2R}{s\,2RC + 1}$$

$$T_V(s) = 1 + \frac{2R}{Z_{eq}(s)} = 1 + \frac{2R}{\frac{2R}{s2RC+1}} = 1 + s\,2RC + 1$$

$$\Downarrow$$

$$\underline{\underline{T_V(s) = 2\,(sRC + 1)}}$$

11–9 Find the voltage transfer function $T_V(s) = V_2(s)/V_1(s)$ in Figure P11–9.

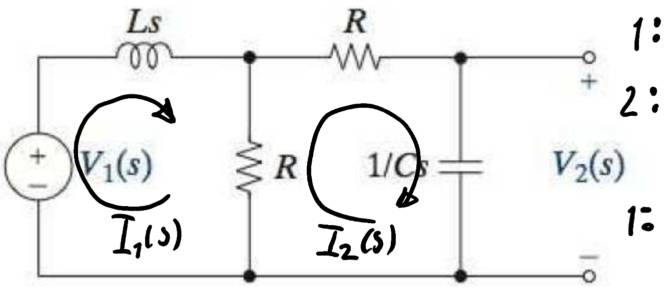

FIGURE P11–9

$$1: I_1(s)\cdot sL + (I_1(s) - I_2(s))R - V_1(s) = 0$$

$$2: I_2(s)\cdot R + I_2(s)\cdot \frac{1}{sC} + (I_2(s) - I_1(s))R = 0$$

$$1: (sL+R)\cdot I_1(s) - R\cdot I_2(s) = V_1(s)$$

$$2: -R\cdot I_1(s) + \left(2R + \frac{1}{sC}\right) I_2(s) = 0$$

$$2: I_1(s) = \frac{2R + \frac{1}{sC}}{R}\cdot I_2(s) = \frac{s2RC+1}{sRC}\cdot I_2(s)$$

$\Downarrow$

$$1: (sL+R)\frac{(s2RC+1)}{sRC}\cdot I_2(s) - R\cdot I_2(s) = V_1(s)$$

$\Downarrow$

$$I_2(s)\left(\frac{(sL+R)(s2RC+1) - sR^2C}{sRC}\right) = V_1(s)$$

$\Downarrow$

$$I_2(s)\left(\frac{s^2 2RLC + sL + s2R^2C + R - sR^2C}{sRC}\right) = V_1(s)$$

$\Downarrow$

$$I_2(s)\left(\frac{s^2 2RLC + s(L + R^2C) + R}{sRC}\right) = V_1(s) \Rightarrow I_2(s) = \frac{V_1(s)\cdot sRC}{s^2 2RLC + s(L+R^2C) + R}$$

$$V_2(s) = I_2(s)\cdot\frac{1}{sC} \Rightarrow V_2(s) = \frac{V_1(s)\cdot R}{s^2 2RLC + s(L+R^2C) + R}$$

$\Downarrow$

$$\underline{\underline{T_V(s) = \frac{V_2(s)}{V_1(s)} = \frac{R}{s^2 2RLC + s(L + R^2C) + R}}}$$

11–15 Find the voltage transfer function $T_V(s) = V_2(s)/V_1(s)$ of the cascade connection in Figure P11–15. Locate the poles and zeros of the transfer function.

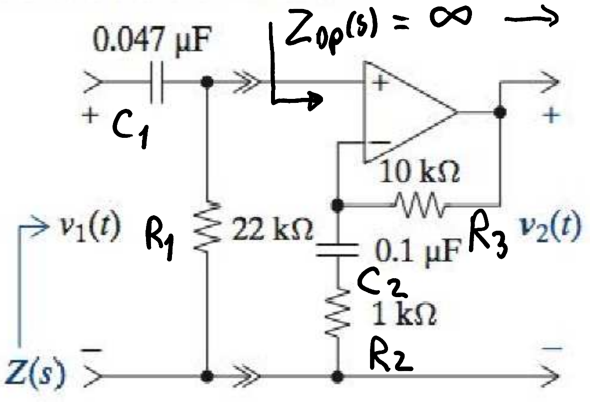

FIGURE P11–15

$\rightarrow$ Apply the Chain-Rule

$$T_V(s) = T_{V1}(s) \cdot T_{V2}(s)$$

$$T_{V1}(s) = \frac{R_1}{\frac{1}{sC_1} + R_1} = \frac{sC_1R_1}{sC_1R_1 + 1}$$

$$T_{V2}(s) = 1 + \frac{R_3}{\frac{1}{sC_2} + R_2} = 1 + \frac{sC_2R_3}{sC_2R_2 + 1} = \frac{sC_2(R_2+R_3) + 1}{sC_2R_2 + 1}$$

$\Downarrow$

$$T_V(s) = \frac{sC_1R_1}{sC_1R_1 + 1} \cdot \frac{sC_2(R_2+R_3) + 1}{sC_2R_2 + 1} = \frac{s}{s + \frac{1}{C_1R_1}} \cdot \frac{C_2(R_2+R_3)\cdot\left(s + \frac{1}{C_2(R_2+R_3)}\right)}{C_2R_2\left(s + \frac{1}{C_2R_2}\right)}$$

$\Downarrow$

$$T_V(s) = \frac{R_2+R_3}{R_2} \cdot \frac{s\cdot\left(s + \frac{1}{C_2(R_2+R_3)}\right)}{\left(s + \frac{1}{C_1R_1}\right)\left(s + \frac{1}{C_2R_2}\right)}$$

$R_1 = 22\,k\Omega$, $R_2 = 1\,k\Omega$, $R_3 = 10\,k\Omega$, $C_1 = 0{,}047\cdot10^{-6}\,F$, $C_2 = 0{,}1\cdot10^{-6}\,F$

$\Downarrow$

$$\frac{1}{C_2(R_2+R_3)} = 909{,}09\ 1/s\ ,\quad \frac{1}{C_1R_1} = 967{,}12\ 1/s\ ,\quad \frac{1}{C_2R_2} = 10000\ 1/s$$

$$\frac{R_2+R_3}{R_2} = 11$$

$\Downarrow$

$$T_V(s) = 11\cdot\frac{s\,(s + 909{,}09)}{(s + 967{,}12)(s + 10000)}$$

$\rightarrow$ Zeros : $s = 0$, $s = -909{,}09$ $1/s$

$\rightarrow$ Poles : $s = -967{,}12$, $s = -10000$ $1/s$