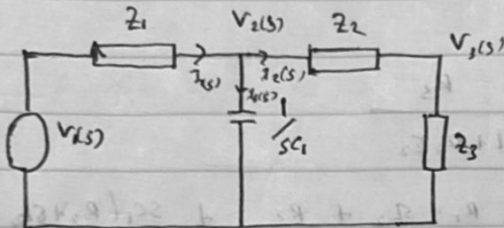
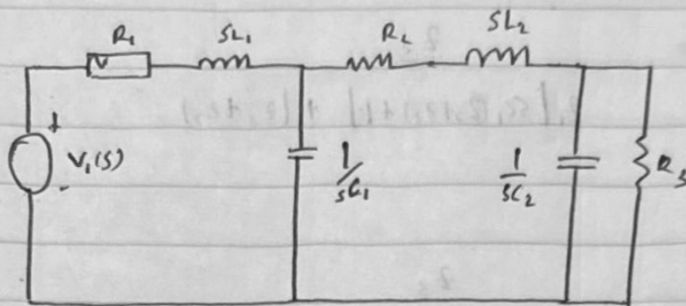


Week 03

activity 01



$$Z_1 = R_1 + sL_1, \quad Z_2 = R_2 + sL_2, \quad Z_3 = \left[ \frac{1}{\frac{1}{R_2} + \frac{1}{sC_2}} \right]^{-1}$$

$$= \frac{R_2}{1 + sR_2C_2}$$

Using Kirchhoff's second law.

$$V_1(s) = V_2(s) + V_3(s)$$

$$\frac{V_1(s) - V_3(s)}{Z_1} = \frac{V_2(s)}{\frac{1}{sC_1}} + \frac{V_3(s)}{Z_3}, \quad \frac{V_2(s)}{Z_3} = \frac{V_2(s) - V_3(s)}{Z_2}$$

$$V_2(s) = \frac{Z_2}{Z_3} V_3(s) + V_3(s)$$

$$\frac{V_1(s) - (Z_2 + Z_3) V_3(s)}{Z_1} = \frac{sC_1(Z_2 + Z_3) V_3(s)}{Z_3} + \frac{V_3(s)}{Z_3}$$

$$= \frac{(Z_2 + Z_3) V_3(s)}{Z_3}$$

$$\frac{Z_3 V_1(s) - (Z_2 + Z_3) V_3(s)}{Z_1} = \left[ sC_1(Z_2 + Z_3) + 1 \right] \frac{V_3(s)}{Z_3}$$

Atlas

$$z_3 V_1(s) = \left[ z_1 (sC_1(z_2 + z_3) + 1) + (z_2 + z_3) \right] V_3(s)$$

$$\frac{V_3(s)}{V_1(s)} = \frac{z_3}{z_1 [sC_1(z_2 + z_3) + 1] + (z_2 + z_3)}$$

$$= \frac{z_3}{z_1 + z_2 + z_3 + sC_1(z_2 + z_3)}$$

$$= \frac{R_3}{R_1 + sL_1 + R_2 + sL_2 + \frac{R_3}{1 + sR_3C_2} + sC_1(R_2 + sL_2 + \frac{R_3}{1 + sR_3C_2})}$$

$$= \frac{R_3}{(R_1 + R_2 + sL_1 + L_2)(1 + sR_3C_2) + (R_2 + sL_2)(1 + sR_3C_2) + R_3 + sC_1(R_2 + sL_2 + \frac{R_3}{1 + sR_3C_2})}$$

$$\frac{V_3(s)}{V_1(s)} = \frac{R_3}{(1 + sR_3C_2) [R_1 + R_2 + s(L_1 + L_2 + R_2C_1 + sL_2C_1)] + R_3(1 + sC_1)}$$

ii) When  $R_3$  is removed  $z_3 = \frac{1}{sC_2}$

$$\frac{V_3(s)}{V_1(s)} = \frac{\frac{1}{sC_2}}{R_1 + sL_1 + R_2 + sL_2 + \frac{1}{sC_2} + sC_1(R_2 + sL_2 + \frac{1}{sC_2})}$$

$$sC_2 [R_1 + R_2 + s(L_1 + L_2 + R_2C_1 + sL_2C_1)] + sC_2 + 1$$