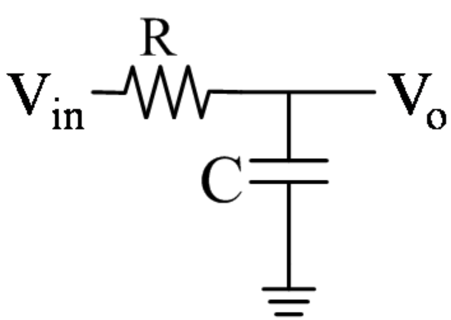
FUNDAMENTAL ON MACROMODELING USING ONLY PRIMITIVE SPICE COMPONENTS

1. Low Pass First Order

$$H_{LP_1} = \frac{k}{1 + s/\omega_p}$$

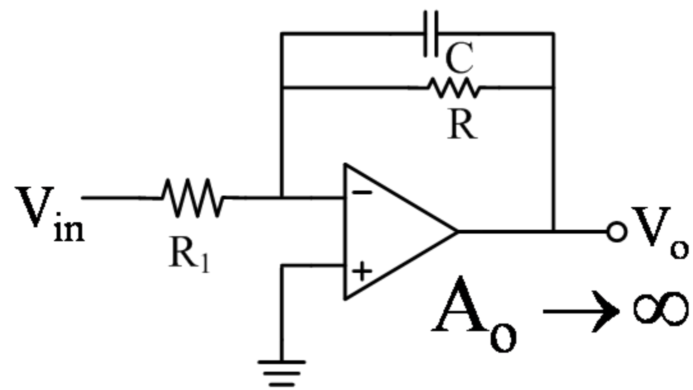
Option 1

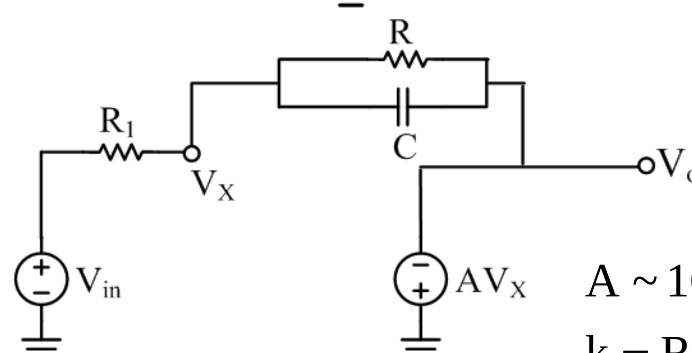


$$\omega_p = \frac{1}{RC}$$

$$k = 1$$

Option 2



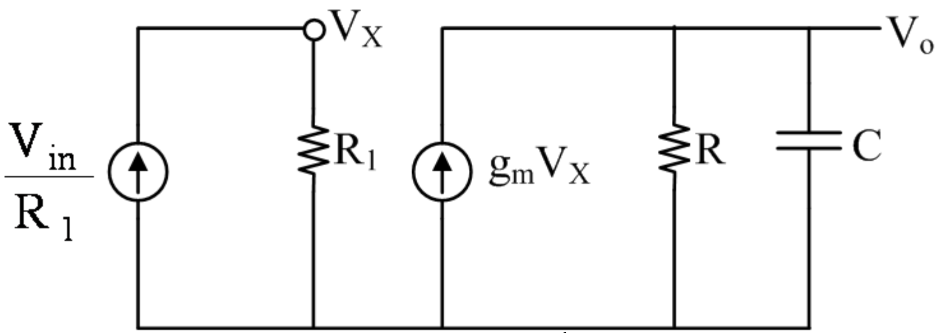


$$A \sim 10^9$$

$$k = R/R_1$$

$$\omega_p = \frac{1}{RC}$$

Option 3

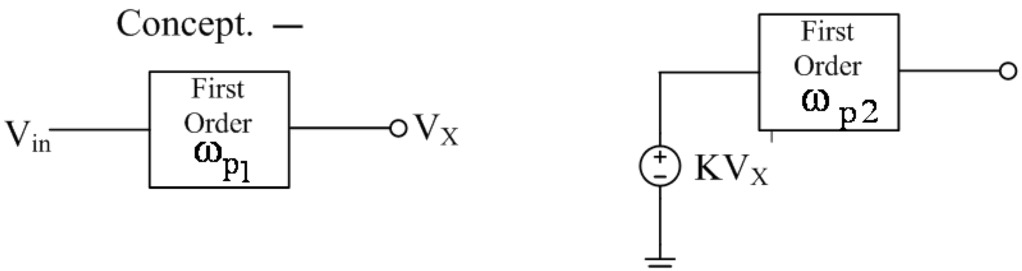


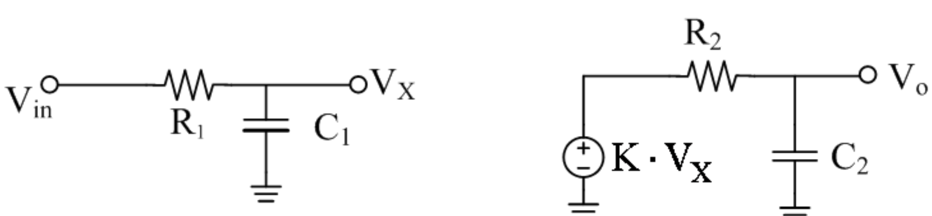
$$k = g_m R \quad ; \quad \omega_p = \frac{1}{RC}$$

2. Higher Order Low Pass

$$H_{LP_2} = \frac{K}{\left(1 + s/\omega_{p_1}\right)\left(1 + s/\omega_{p_2}\right)}$$

Concept. –



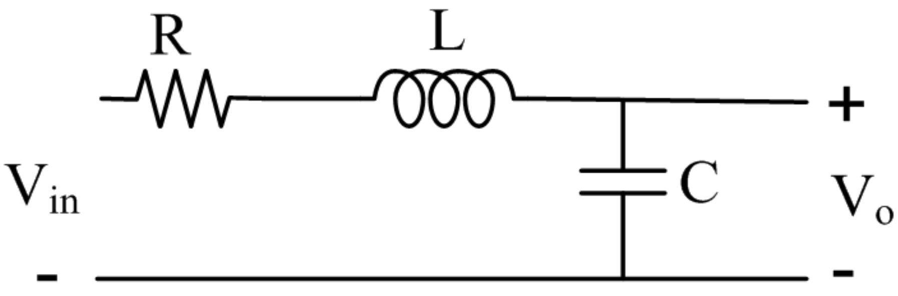


$$\omega_{p_1} = 1/R_1C_1$$

$$\omega_{p_2} = 1/R_2C_2$$

$$K = K$$

$$H_{LP_3} = \frac{K_o}{s^2 + \frac{\omega_o}{Q}s + \omega_o^2}$$



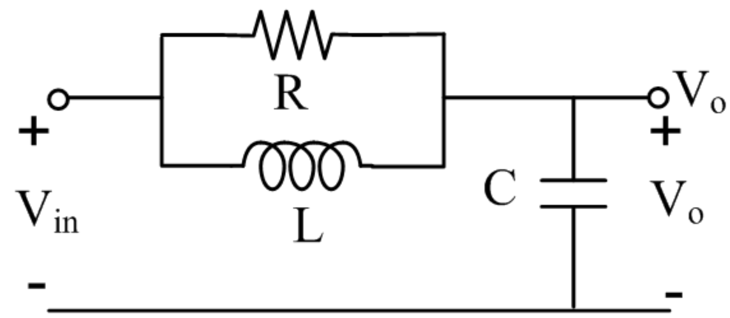
$$K_o = 1/LC \quad ; \quad H_{LP_3}(0) = 1$$

$$\omega_o^2 = 1/LC$$

$$\frac{\omega_o}{Q} = \frac{R}{L}$$

Resonator (one zero, two complex poles)

$$H_R = \frac{k(1 + s/\omega_z)}{s^2 + \frac{\omega_o}{Q}s + \omega_o^2}$$



$$k = 1/LC$$

$$\omega_z = R/L$$

$$\omega_o^2 = 1/LC$$

$$\frac{\omega_o}{Q} = 1/RC$$

$$\text{Using}\ \ H(s) = \frac{-Y_1(s)}{Y_F(s)}$$

$$H(s) = \frac{-K_o}{s^2 + \frac{\omega_o}{Q}s + \omega_o^2}$$

$$H(s) = \frac{-k_o/s}{s + \frac{\omega_o}{Q} + \frac{\omega_o^2}{s}}$$