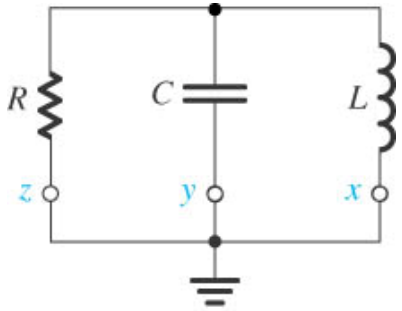
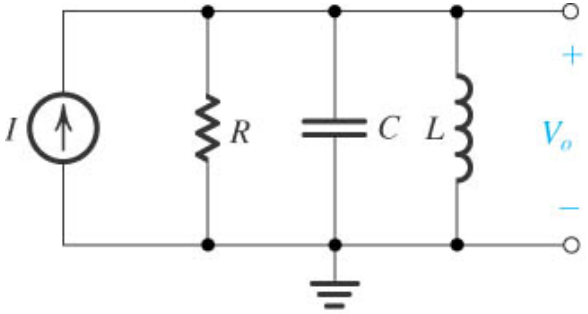
Second Order Parallel LCR Resonator

$$\frac{Vo}{I} = \frac{1}{Y} = \frac{1}{(1/sL) + sC + (1/R)} = \frac{s/C}{s^2 + s(1/CR) + (1/LC)}$$

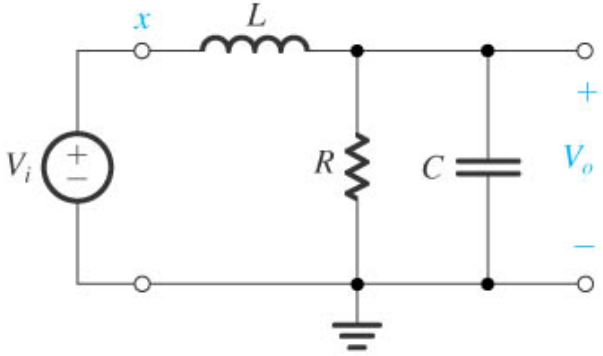
$$\omega_0^2 = 1/LC;\ \omega_0 = 1\sqrt{LC};\ Q = \omega_0 CR$$



(a)



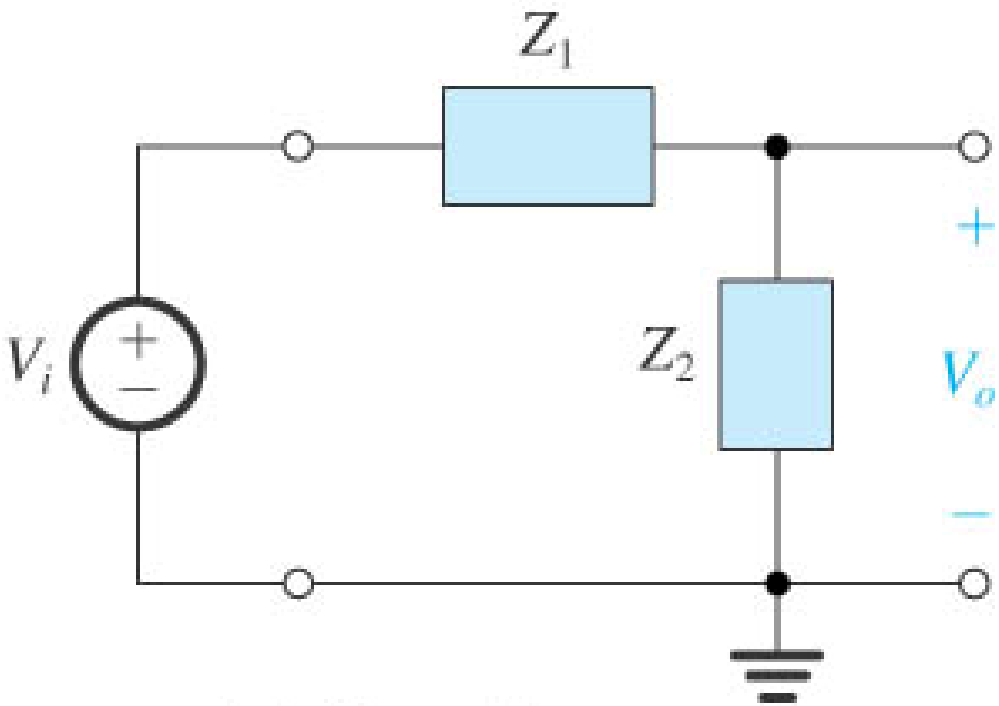
(b)



(c)

Second Order Filter

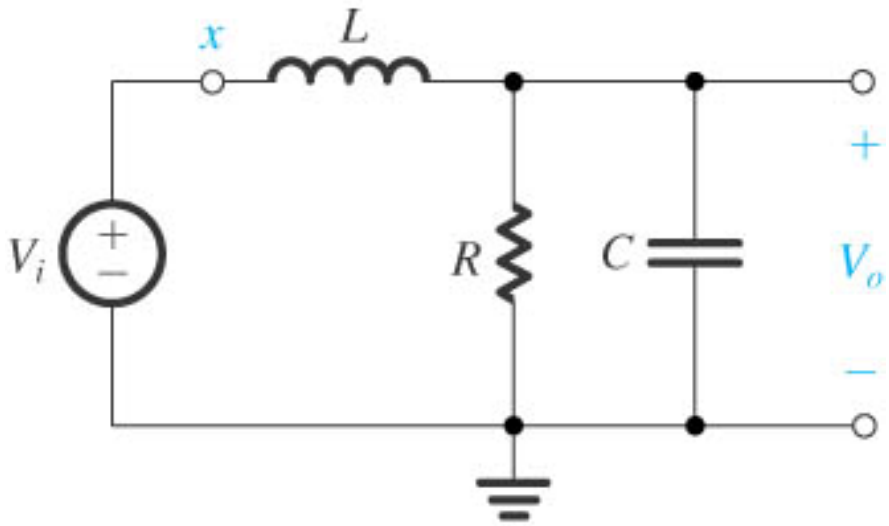
$$T(s) = \frac{V_0(s)}{V_i(s)} = \frac{Z_2(s)}{Z_1(s) + Z_2(s)}$$



(a) General structure

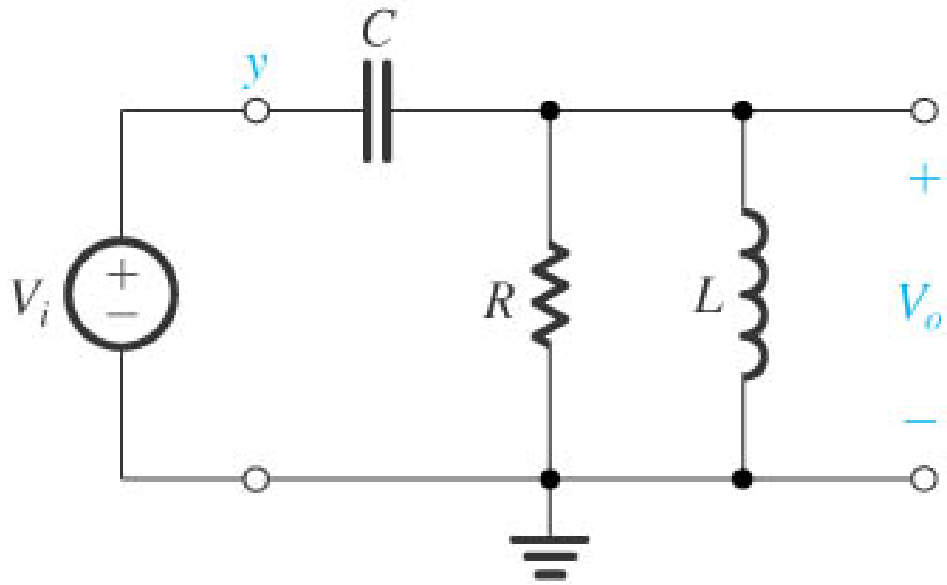
Low Pass Filter

$$T(s) = \frac{1/LC}{s^2 + s(1/CR) + (1/LC)}$$



(b) LP

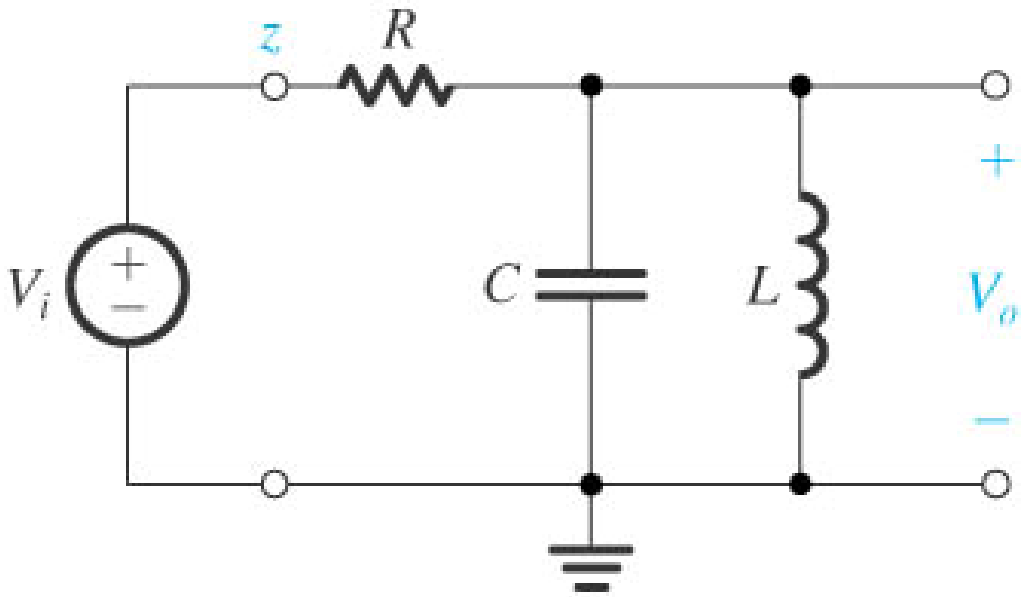
High Pass Filter



(c) HP

Band Pass Filter

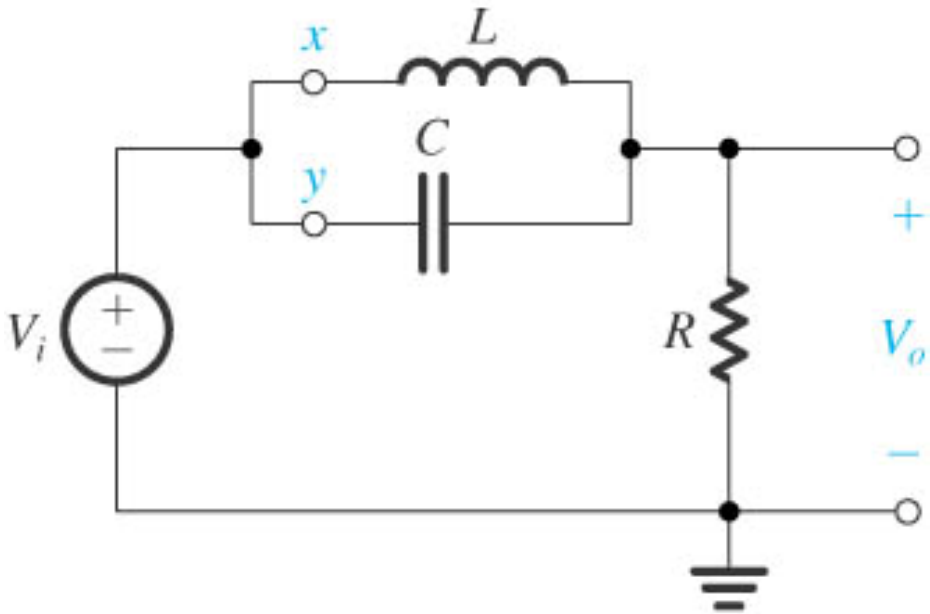
$$T(s) = \frac{s(1/CR)}{s^2 + s(1/CR) + (1/LC)}$$



(d) BP

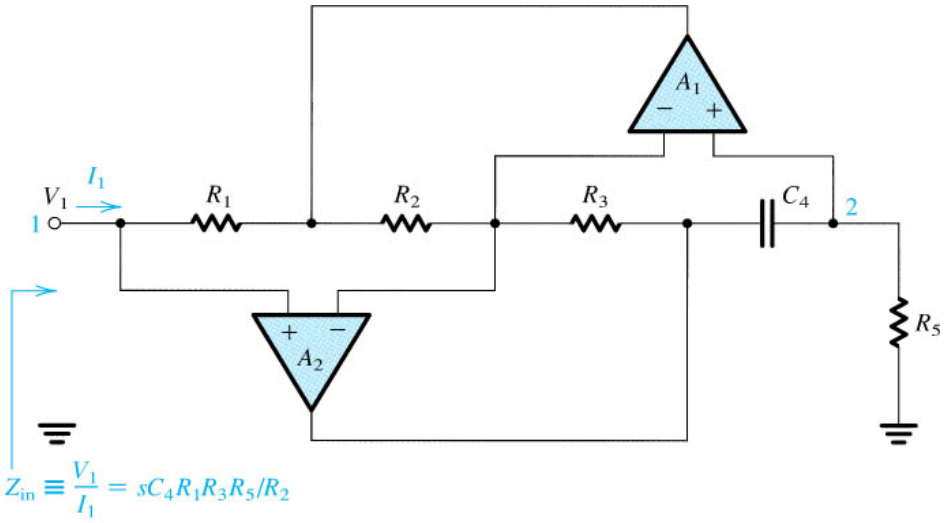
Notch at ω_0

$$T(s) = \frac{s^2 + (1/L1C)}{s^2 + s(1/CR) + [1/(L_1 // L_2)C]}$$



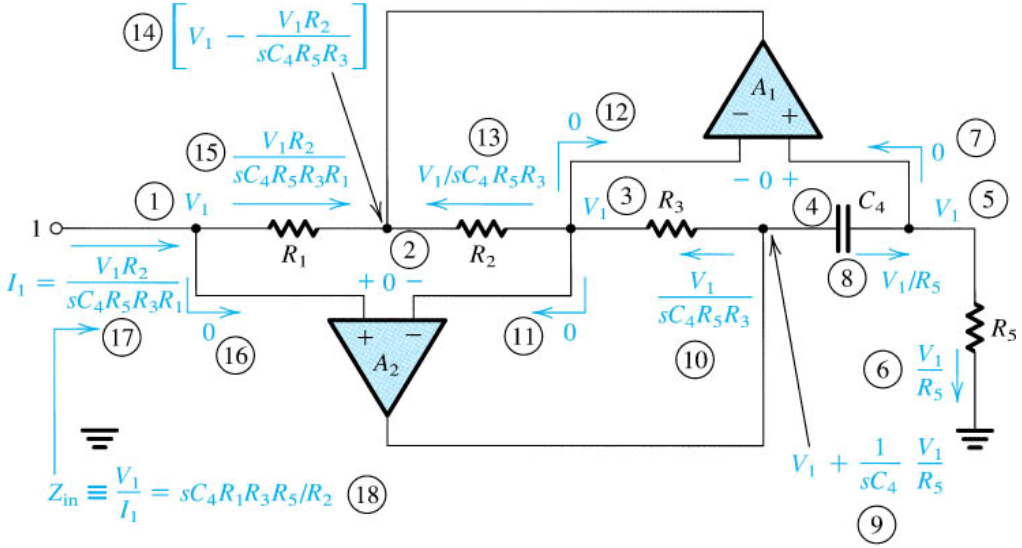
(e) Notch at ω_0

Second Order Filters Based on Inductor Replacement



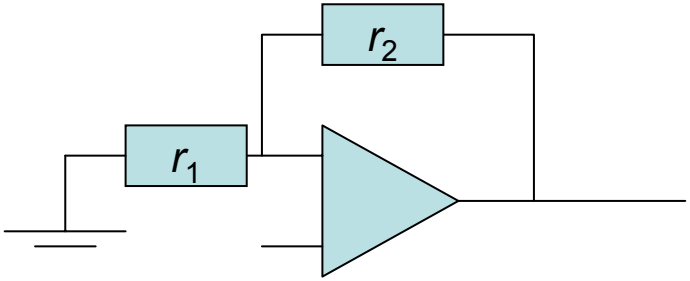
(a)

$$L = C_4 R_1 R_3 R_5 / R_2$$

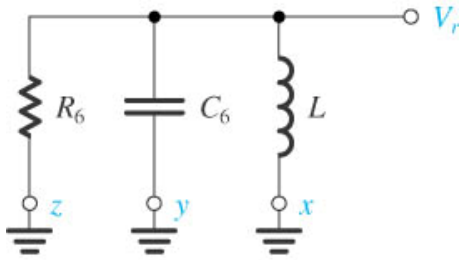


(b)

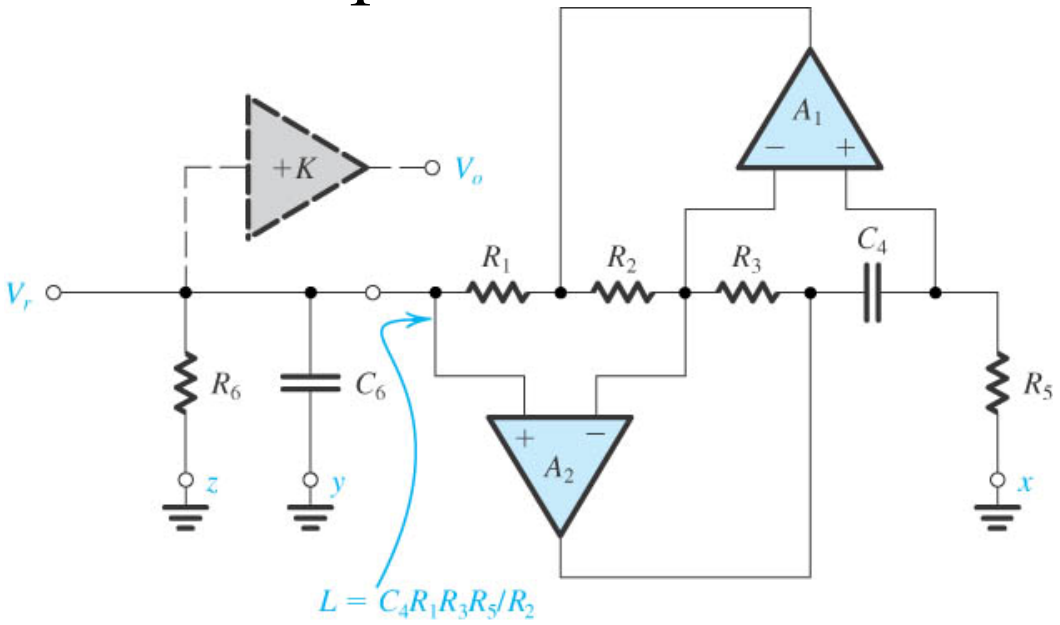
An op-amp RC resonator obtained by replacing L in the *LCR* circuit



$$K = 1 + \frac{r_2}{r_1}$$

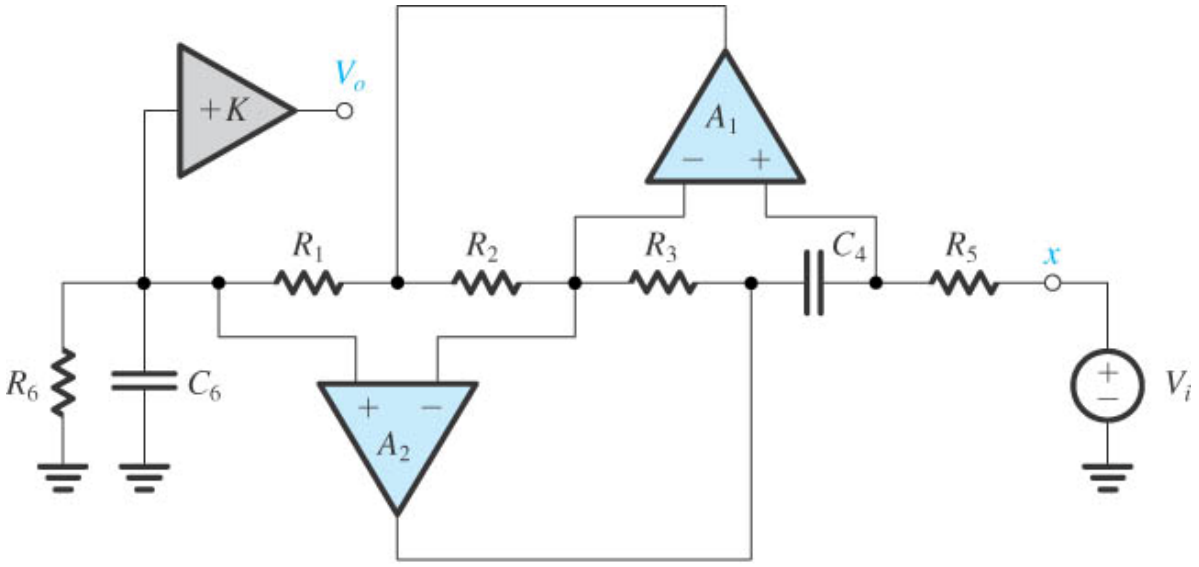


(a)



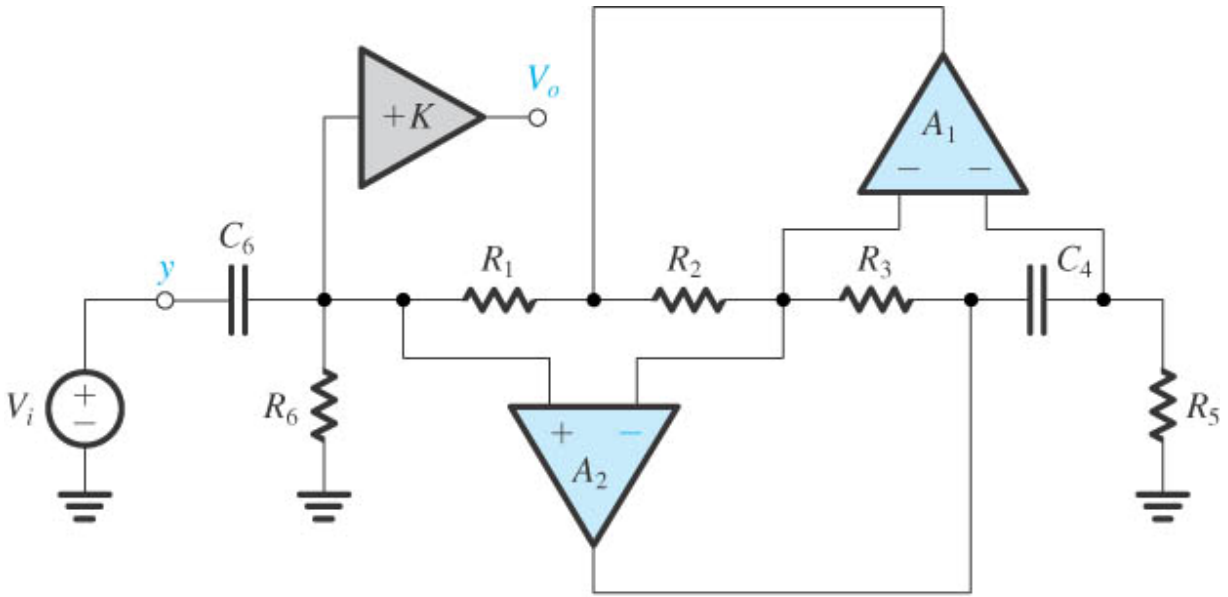
(b)

Low Pass Filter



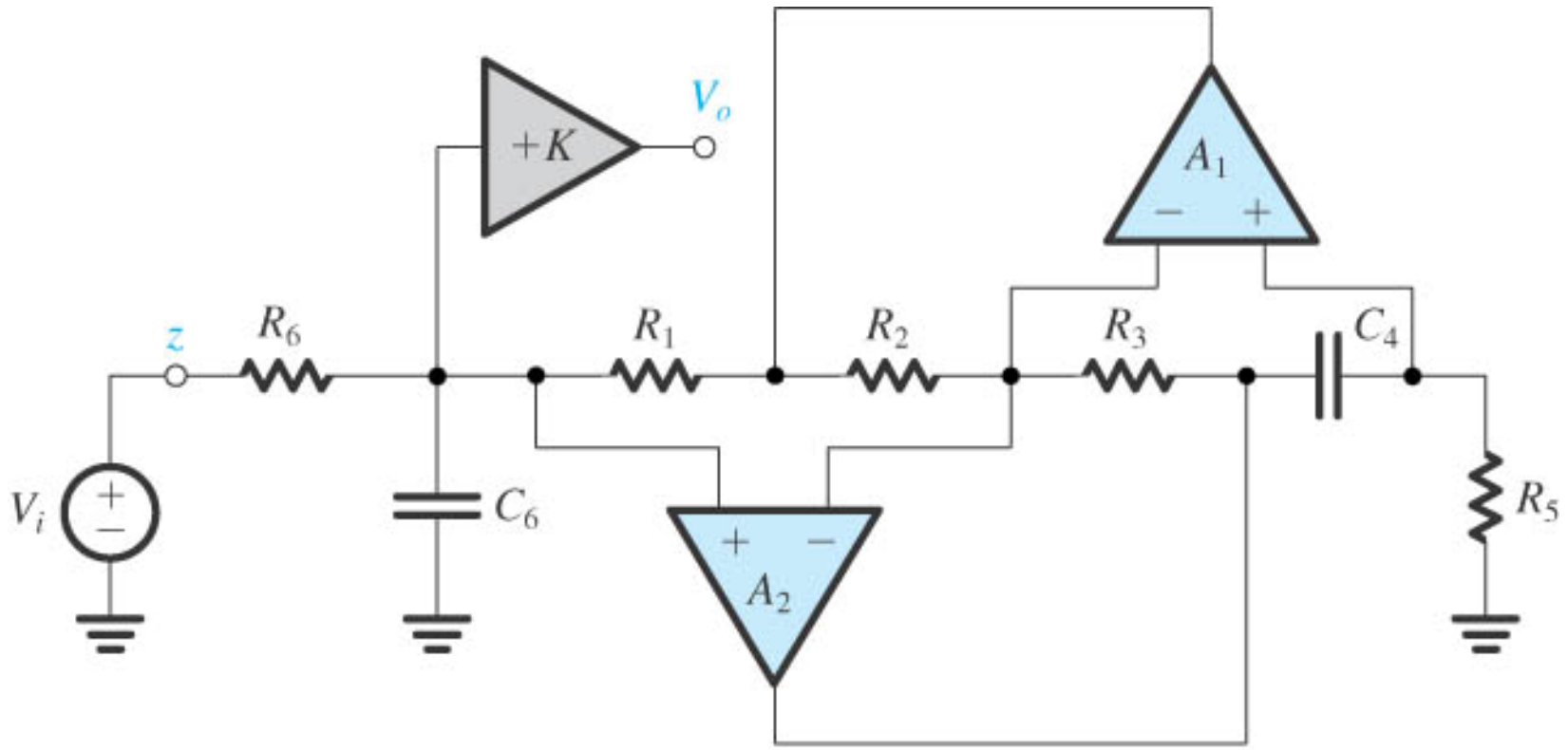
(a) LP

High Pass Filter

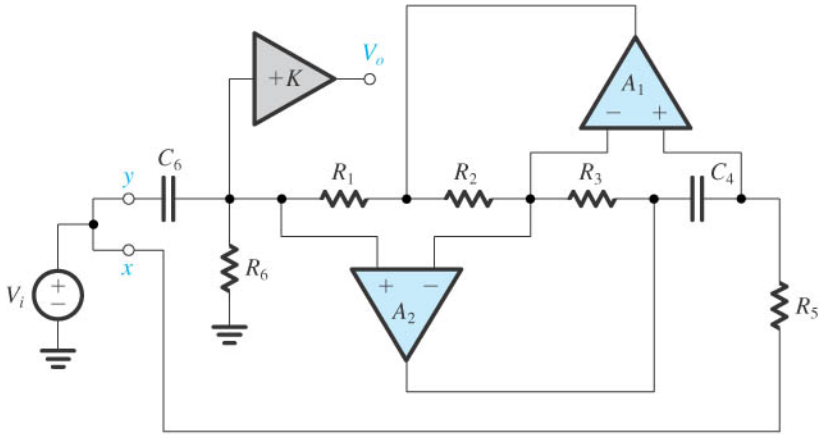


(b) HP

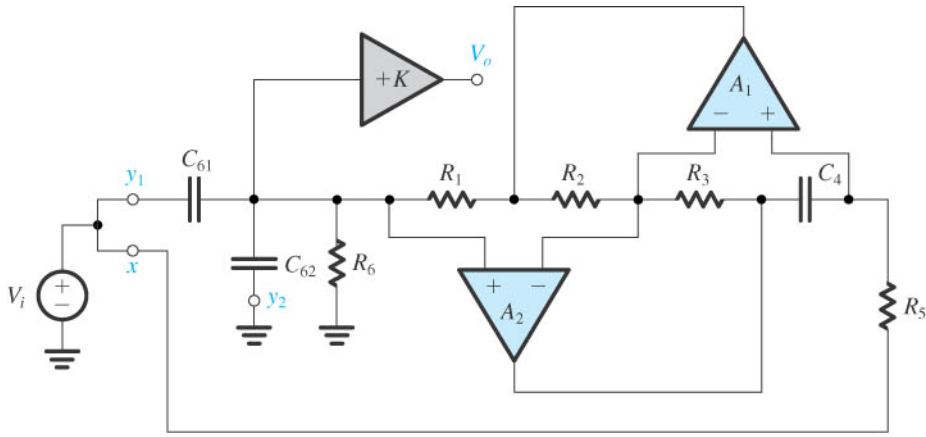
Band Pass Filter



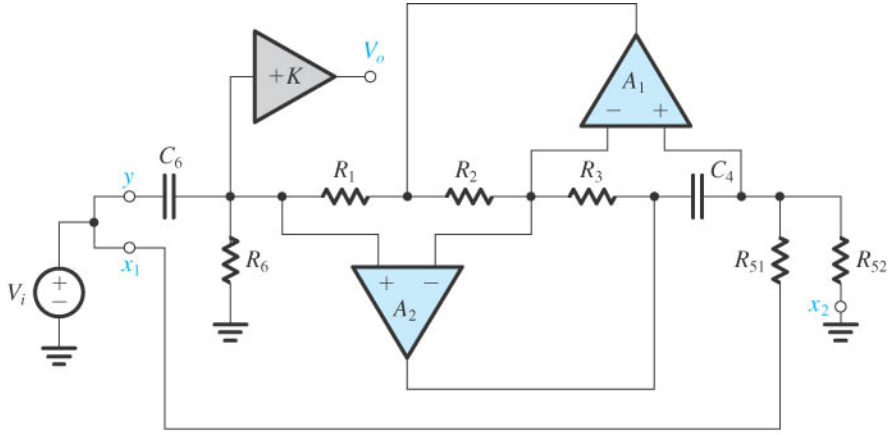
(c) BP



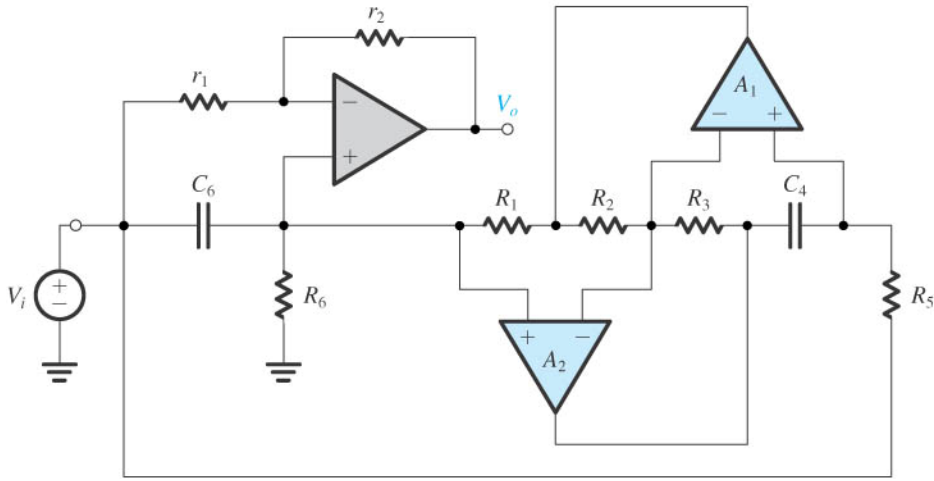
(d) Notch at ω_0



(e) LPN, $\omega_n \geq \omega_0$



(f) HPN, $\omega_n \leq \omega_0$



(g) All-pass