2
LINEAR ACTIVE FILTERS LIST

First of all some definitions and a few necessary constants:

krad $\equiv 10^3 \cdot$rad , Mrad $\equiv 10^6 \cdot$rad,

Amplifier Gain: A_0 ,

Cut off frequency: f_0 ,

Period: $T_0 = \dfrac{1}{f_0}$,

angular frequency: $\omega_0 = 2 \cdot \pi \cdot f_0$,

time constant: $\tau = \dfrac{1}{\omega_0}$

Quality factor: Q ,

damping factor: $\zeta = \dfrac{\omega_0}{2 \cdot Q}$,

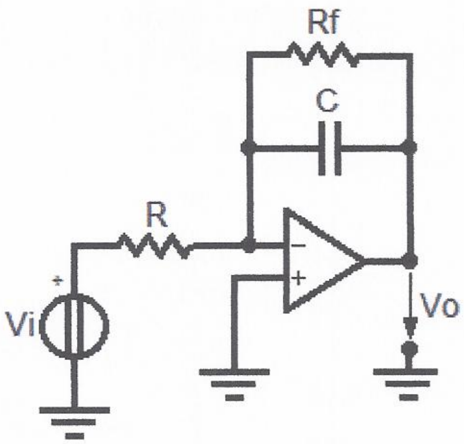
sampling frequency: f_s ,

sampling period: $T_s = \dfrac{1}{f_s}$,

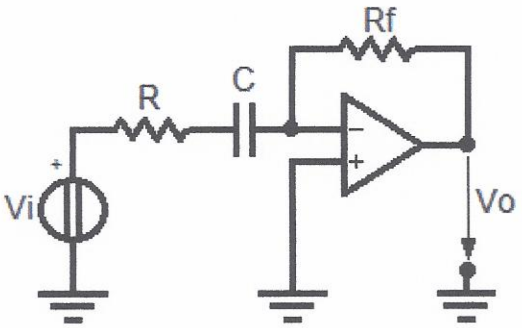
sampling angular frequency: $\omega_s = 2 \cdot \pi \cdot f_s$.

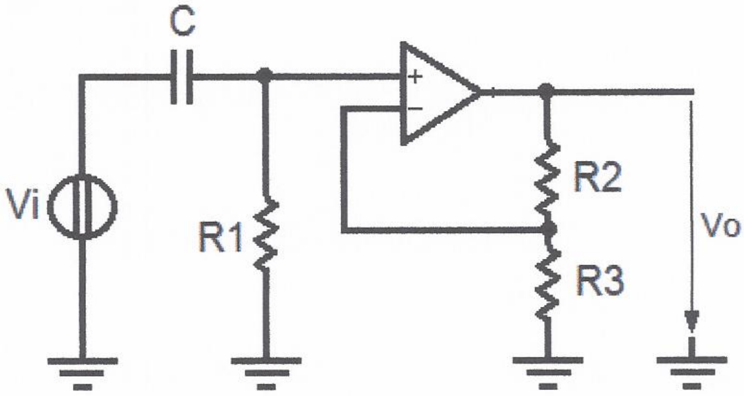
The eight basic linear active filters transfer functions (t. f.) as Laplace transforms of their impulse responses H(t), (functions of the complex frequency s=σ+jω) are:

2.1) Low Pass FIlter or inverting integrator (I°order): $W1(s) = \dfrac{A_0 \cdot \omega_0}{s + \omega_0}$,

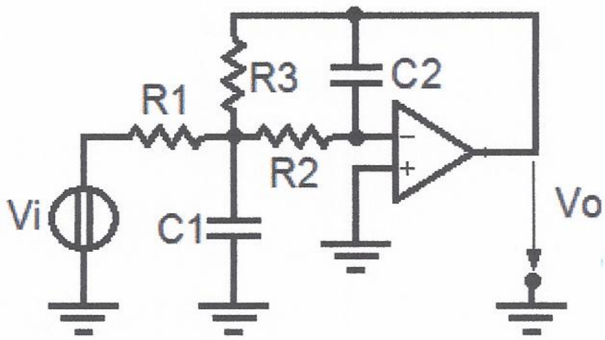


2.2) High Pass or inverting derivator (I° order): $W2(s) = \frac{A_0 \cdot s}{s + \omega_0}$,

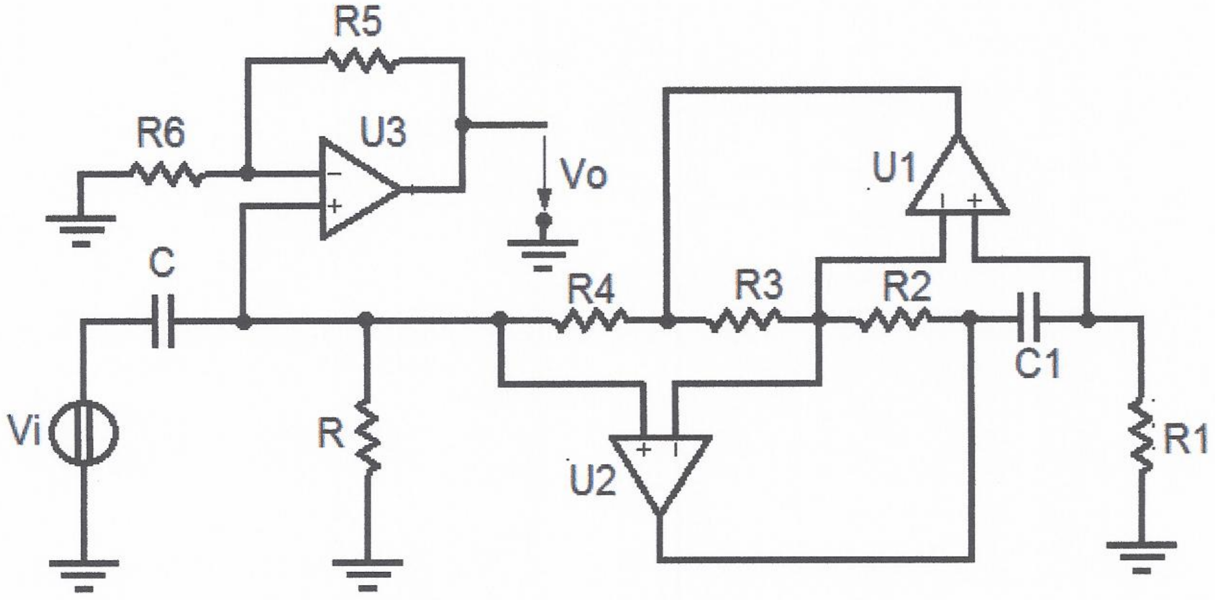




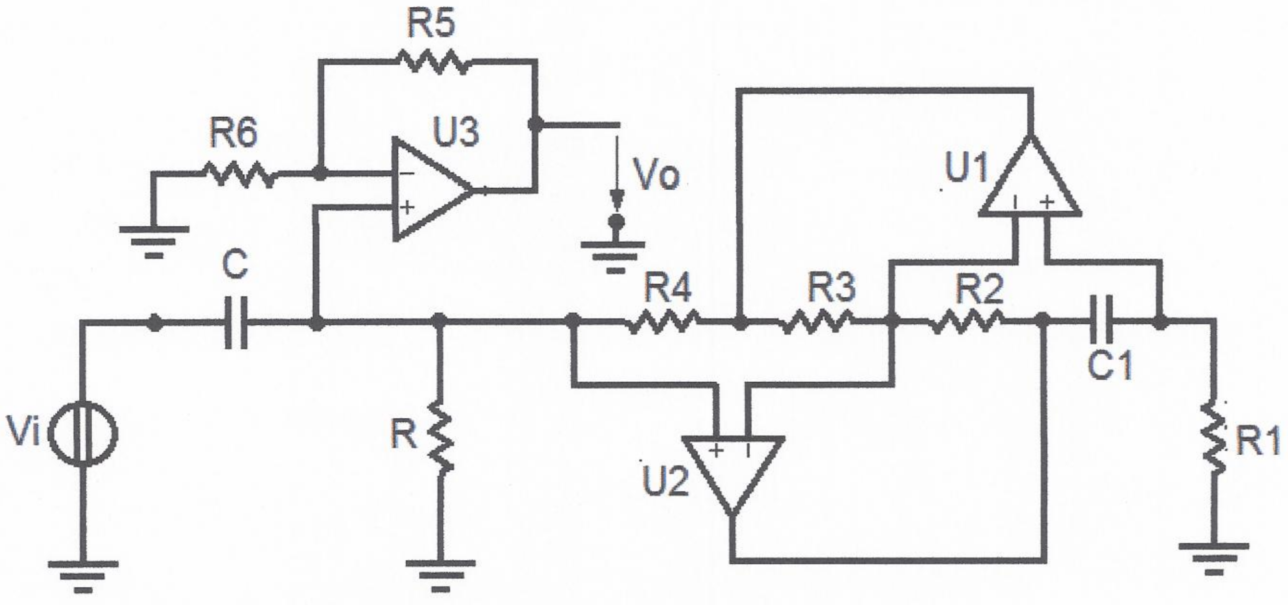
2.3) Low Pass (II°order): $W3(s) = \frac{A_0 \cdot \omega_0^2}{s^2 + 2 \cdot \zeta \cdot s + \omega_0^2}$,



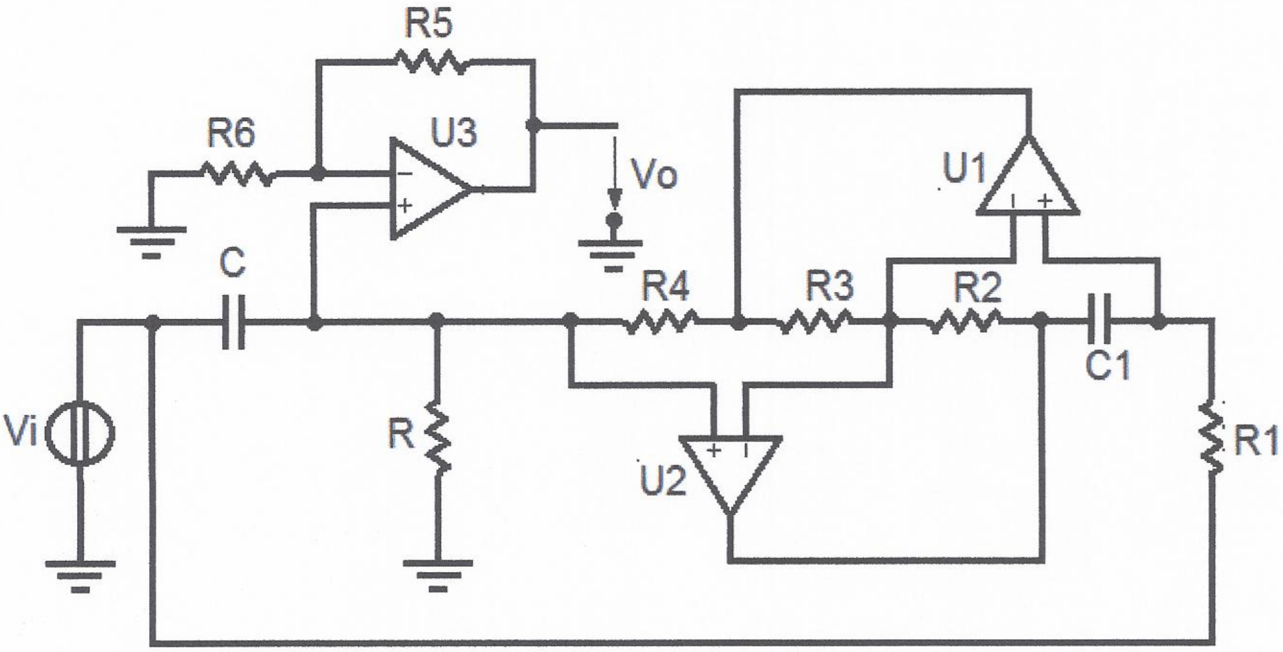
2.4) High Pass (II°order): $W4(s) = \frac{A_0 \cdot s^2}{s^2 + 2 \cdot \zeta \cdot s + \omega_0^{\,2}}$,



2.5) Band Pass (II°order): $W5(s) = \frac{A_0 \cdot 2 \cdot \zeta \cdot s}{s^2 + 2 \cdot \zeta \cdot s + \omega_0^{\,2}}$,

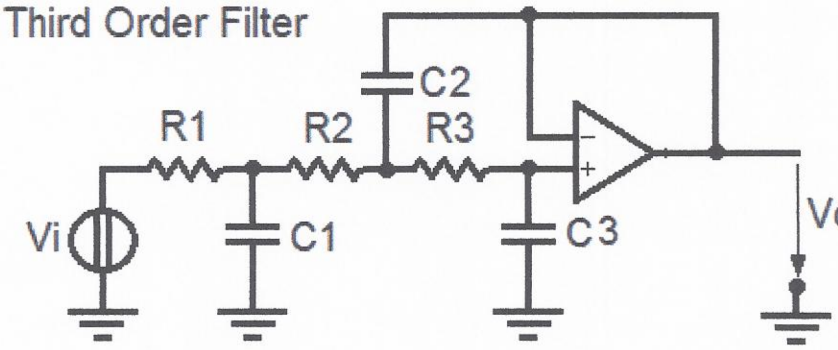


2.6) Band stop (II°order): $W6(s) = \dfrac{A_0 \cdot \left(s^2 + \omega_0^2\right)}{s^2 + 2 \cdot \zeta \cdot s + \omega_0^2}$,



2.7) Butterworth Filter: $WBw(s) = \dfrac{A_0}{Bw_n(s)}$, where we have indicated

with $Bw_n(s)$ the Butterworth polinom of nth grad.



2.8) Chebyshev Filter: $WCh(s) = \frac{A_0}{Tch(s)}$.

(Starting roll-off, greater than that of Butterworth.)

Fourth order filter