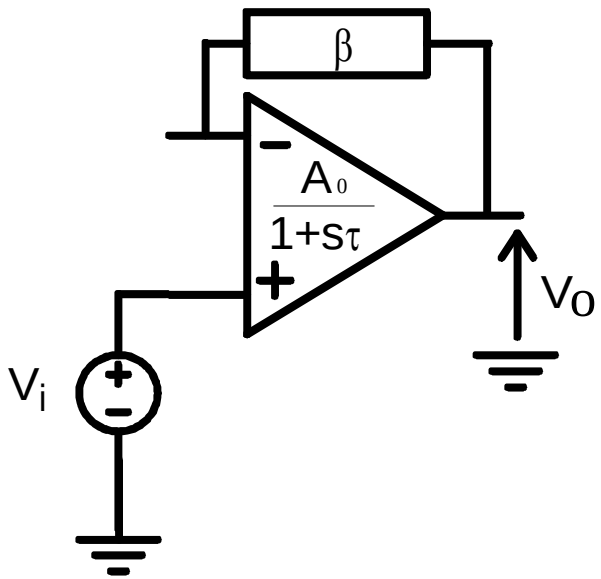
Operational amplifier: small signals behavior



$$G_{loop}(s) = -\beta \cdot A(s)$$

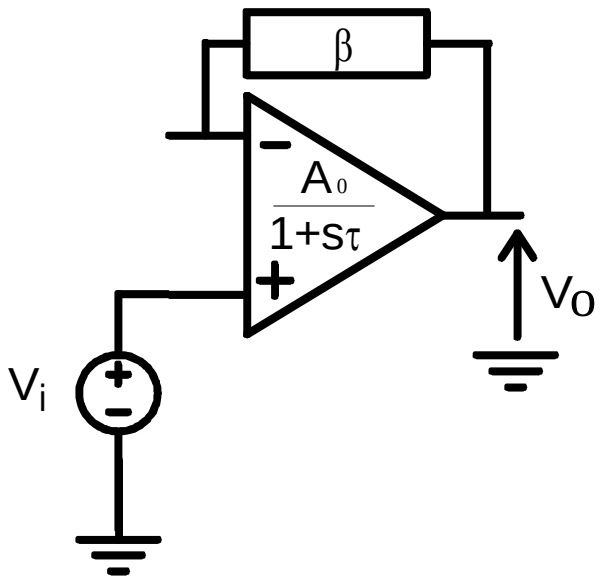
$$T(s) = \frac{V_o(s)}{V_i(s)} = \frac{A(s)}{1 + \beta \cdot A(s)}$$

$$T(s) = \frac{A_o}{1+s\tau} \cdot \frac{1}{1+\beta \cdot \frac{A_o}{1+s\tau}} = \frac{A_o}{1+\beta A_o + s\tau}$$

$$\Rightarrow \quad T(s) = \frac{A_o}{1+\beta A_o} \cdot \frac{1}{1+s \cdot \frac{\tau}{1+\beta A_o}} = \frac{A_0'}{1+s\tau'} \quad \Rightarrow \quad A_0' \cdot \frac{1}{\tau'} = A_0 \cdot \frac{1}{\tau}$$

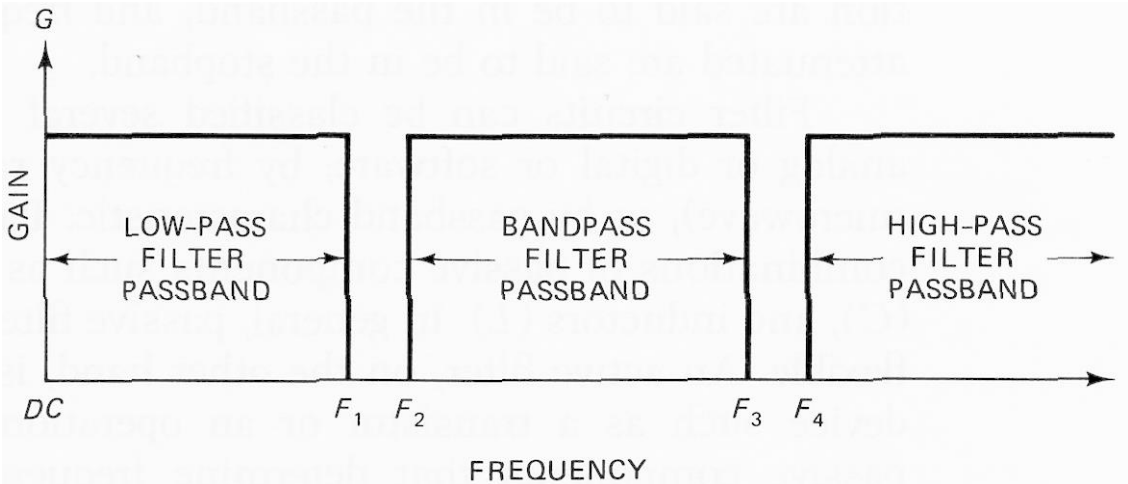
the gain-bandwidth product is a constant

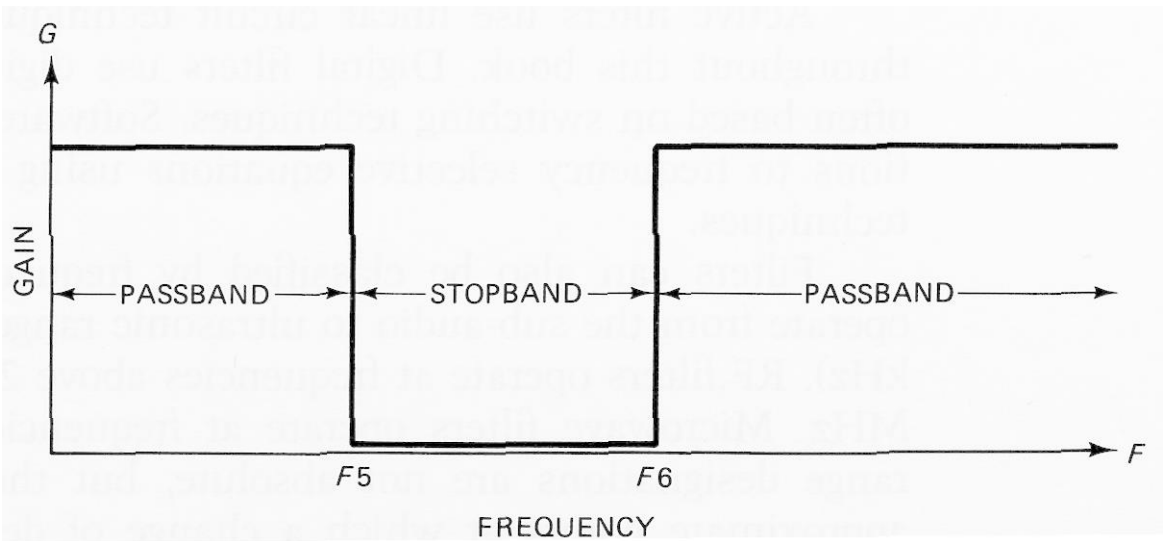
Operational amplifier: selecting the right one



$$A_0' \cdot \frac{1}{\tau'} = A_0 \cdot \frac{1}{\tau}$$

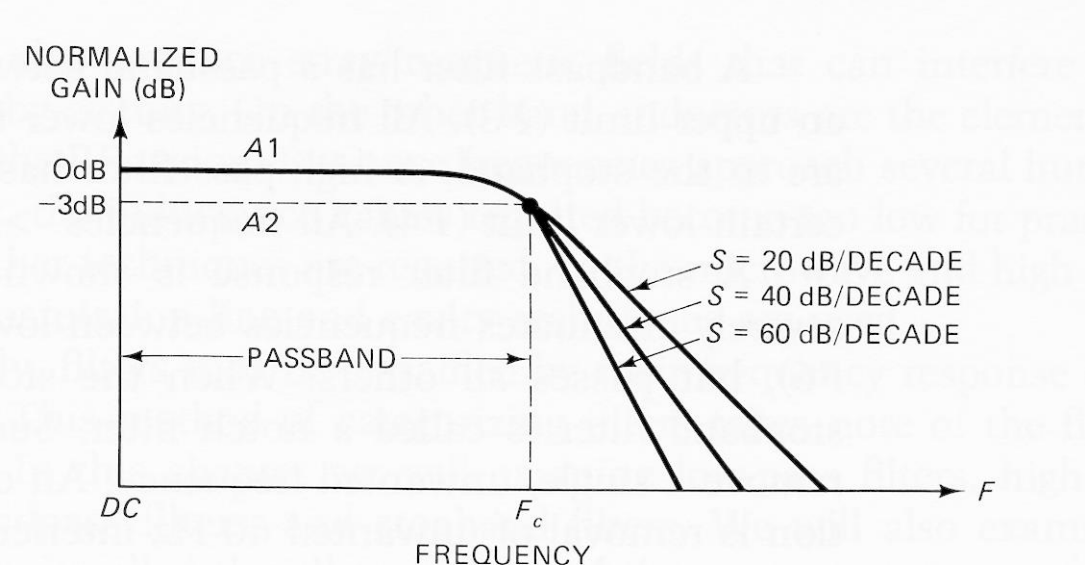
Ideal linear filters



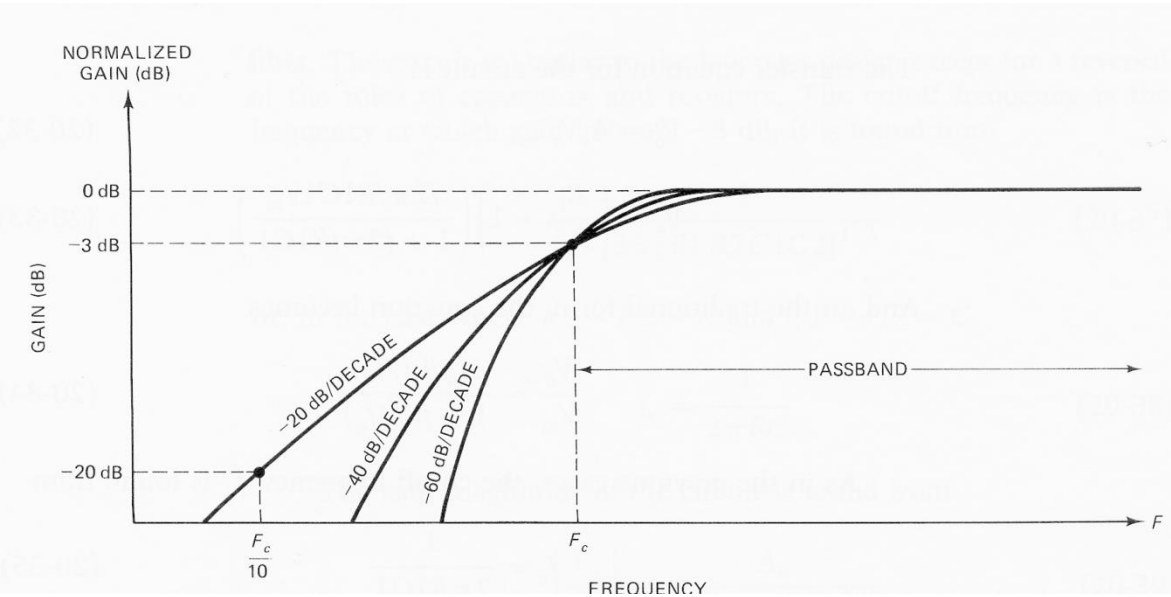


Butterworth filters

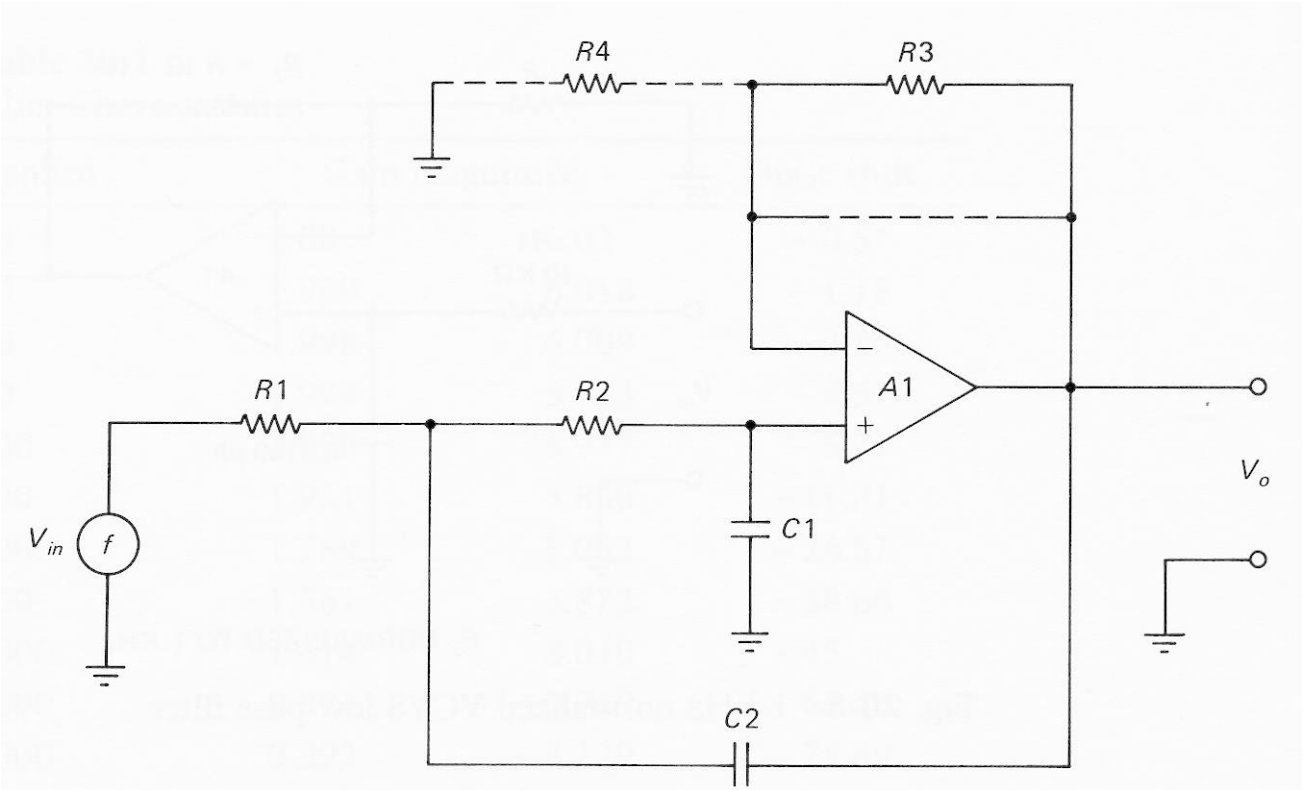
- low-pass



- high-pass



Example of second order LP filter



Example of second order HP filter