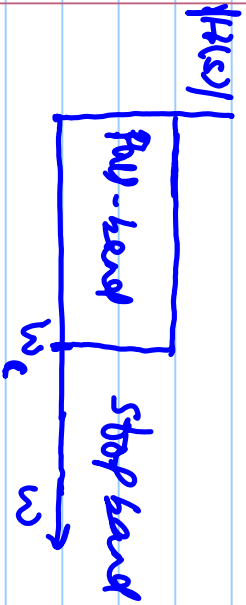
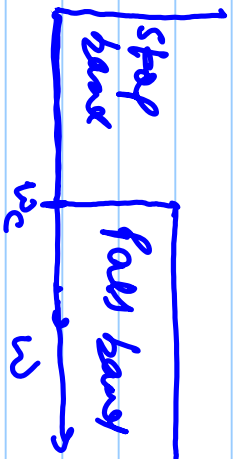


Types of Filters

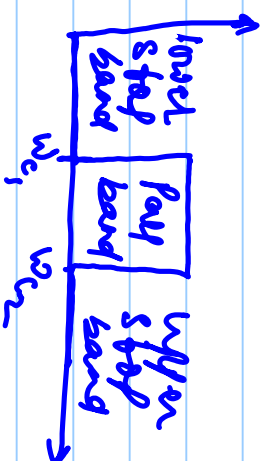
Low-pass Filter



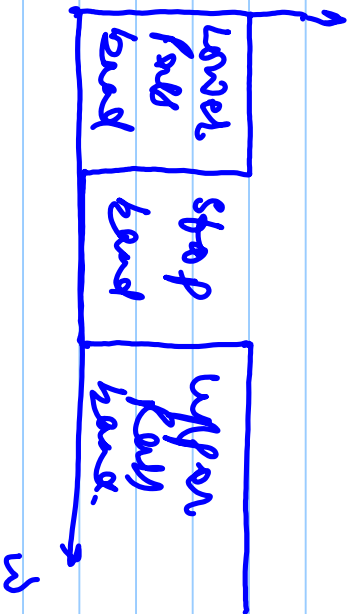
High-pass Filter



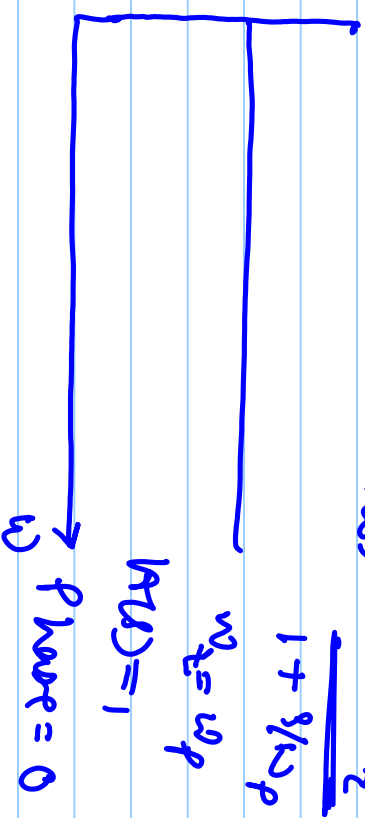
Band-pass Filter



Band-Reject Filter



All-pass Filter

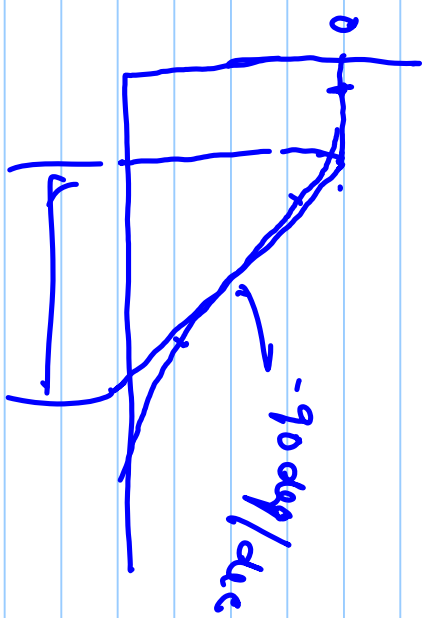
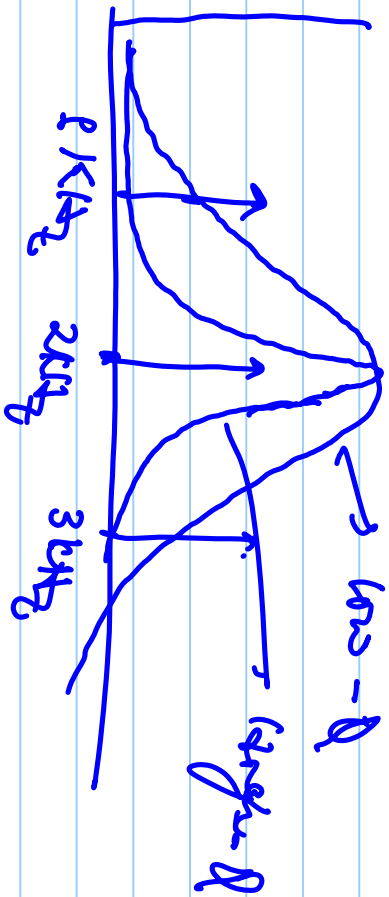


$$|H(\omega)| = \frac{1 - \beta/\omega_c}{1 + \beta/\omega_c}$$

$$\omega_c = \omega_p$$

$$|H(\omega)| = 1$$

$$\angle \phi_{\text{phase}} = 0$$



First Order Filter

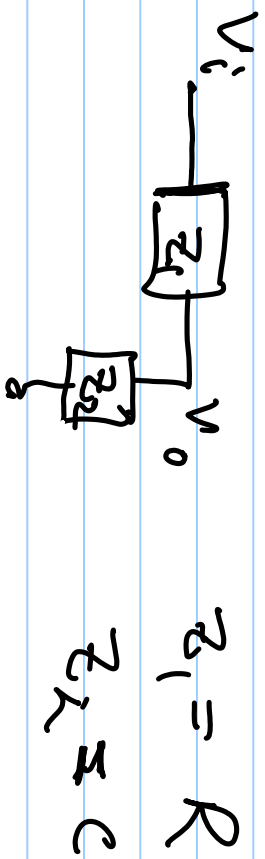
Low Pass

$$H(s) = \frac{I}{1 + s/\omega_c}$$

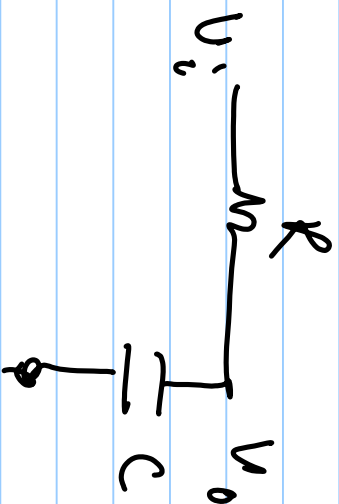
$$= \frac{1/s \rightarrow z_2}{1/s + \frac{1}{\omega_c} \rightarrow z_1}$$

Asympt.

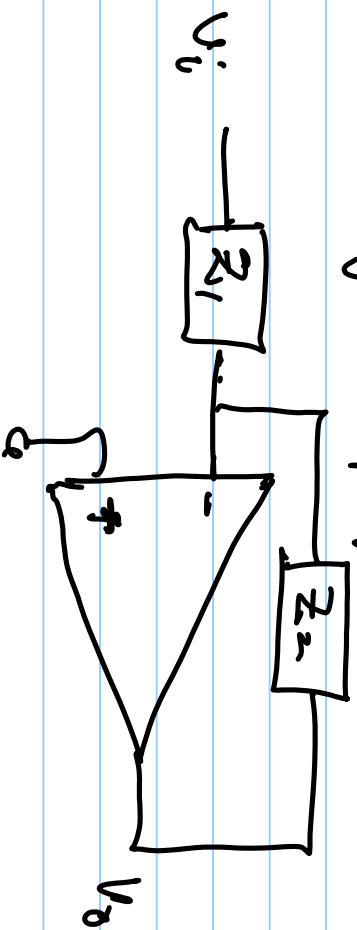
$$\frac{A_0}{1 + s/\omega_c}$$



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

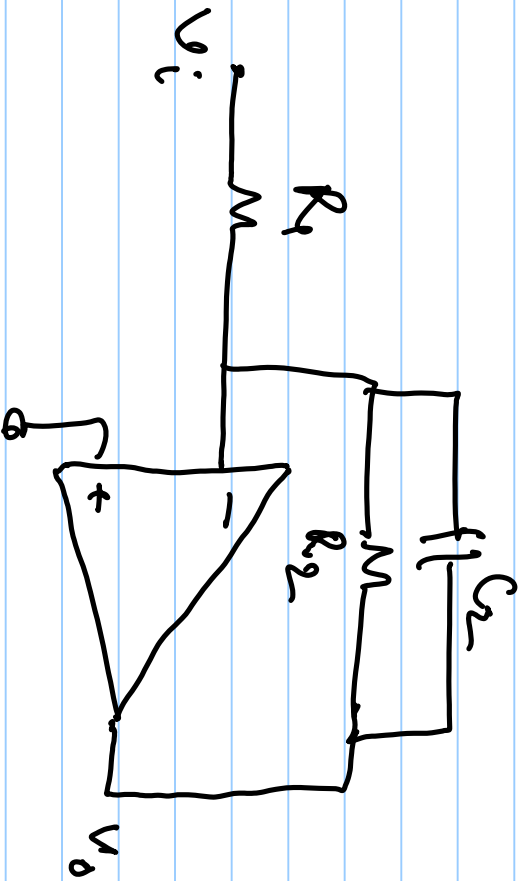


Inverting Amplifier

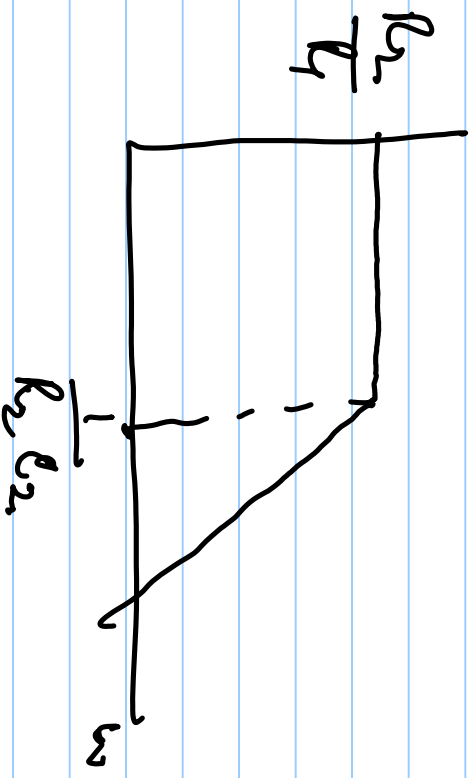


$$\frac{V_o}{V_i} = -\frac{Z_2}{Z_1}$$

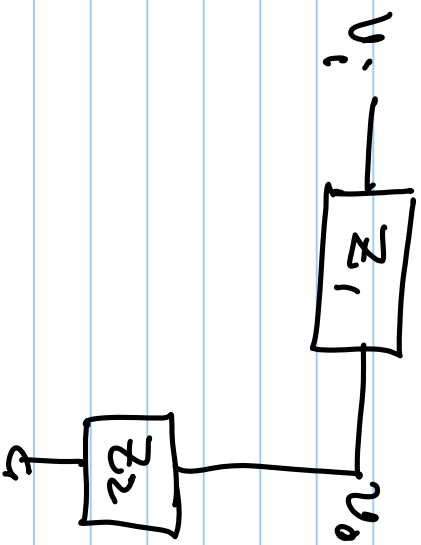
$$-\frac{R_2}{Z_1} = -\frac{V_1}{Y_2} = -\frac{I/R_1}{\frac{1}{R_2} + sC_2} = -\frac{R_2 \times \frac{1}{R_1}}{1 + R_2 C_2 s}$$



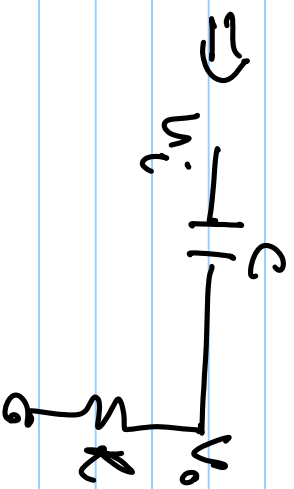
$$= -\frac{A_0}{1 + R_2 C_2 s}$$



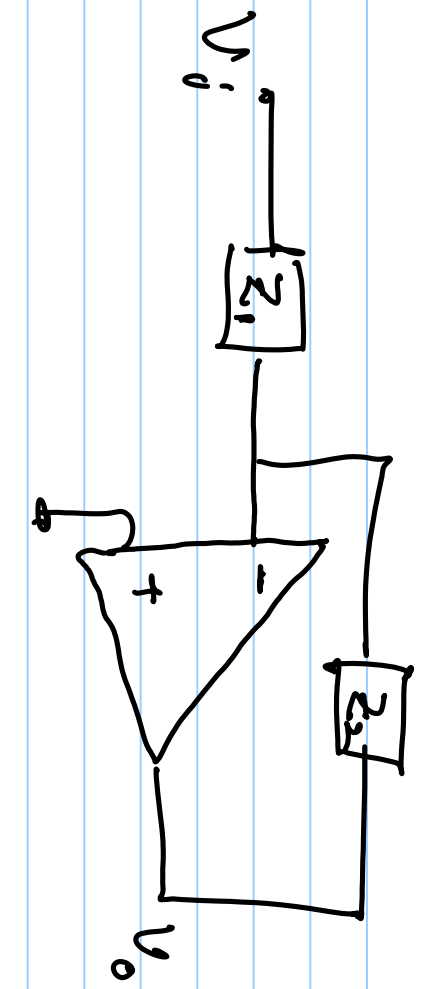
Single Pass Filter



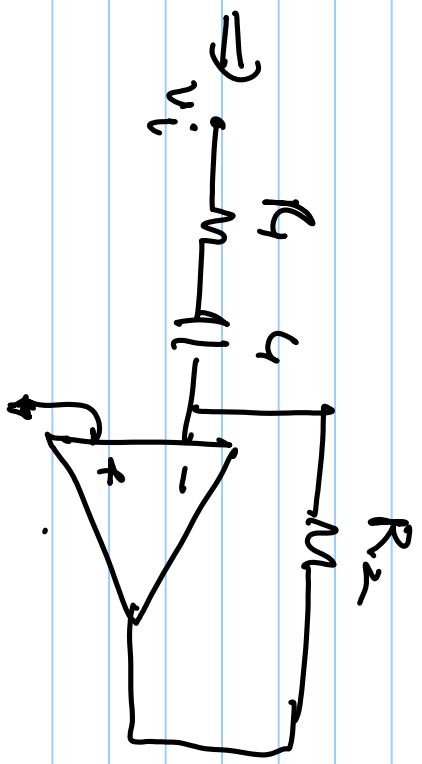
$$H(s) = \frac{R(s)}{1 + R(s)} = \frac{R \rightarrow Z_2}{1 + R \rightarrow Z_1 + R \rightarrow Z_2}$$
$$\frac{v_o}{v_i} = \frac{Z_2}{Z_1 + Z_2}$$



Aktiv High Pass Filter



$$\frac{V_o}{V_i} = - \frac{Z_2}{Z_1}$$



$$H(s) = \frac{R_2 s}{1 + R_2 s} = \frac{R_2}{\frac{1}{s} + R_2} \rightarrow Z_2$$

$\frac{1}{s} \rightarrow Z_1$

