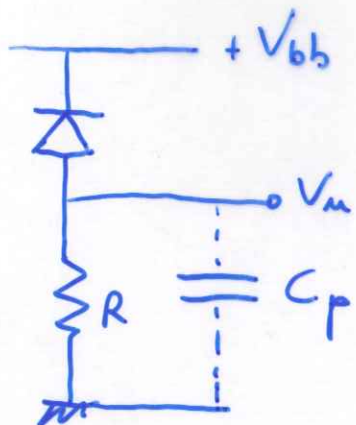


# Circuiti per fotodiodi

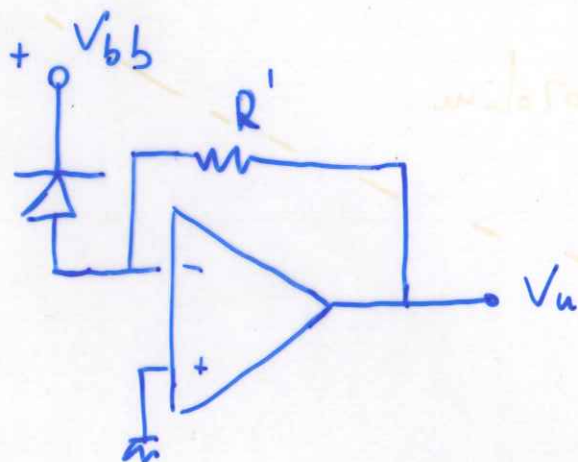


$$B = \frac{1}{2\pi RC}$$

$$C = C_p + C_g$$

$$i_n^2 = \frac{4kTB}{R}$$

- schema a transimpedenza



$$R^* = \frac{R'}{1+A}$$

$$\text{se } R' = R \rightarrow B^* = (1+A)B$$

$$R' = R(1+A) \rightarrow V_n^* = (1+A)V_n$$

miglior rapporto segnale rumore.

ma l'amplificazione non è reale!



- tenuto conto della risposta in frequenza

$$V_u(s) = -G P Z \gamma(s) = - \frac{G P Z}{1 + \frac{1}{A} \left(1 + \frac{Z}{Z_i}\right)}$$

$$Z = R \parallel C_R \quad Z_i = R_i \parallel (C_{in} + C)$$

$$\frac{V_u(s)}{V_u(0)} = \frac{1}{\left\{ 1 + s \left[ R C_R + \left(1 + \frac{R}{R_i}\right) / \omega_0 A_0 + \frac{R}{A_0} (C_i + C_R) \right] + s^2 \frac{R (C_i + C_R)}{\omega_0 A_0} \right\}}$$

comportamento II ordine

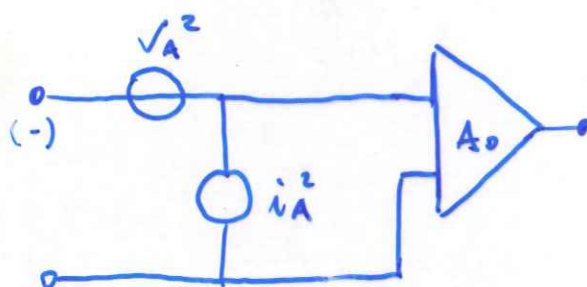
$$f_z = \frac{1}{\left[ 2 \pi R (C_i + C_R) / \omega_0 A_0 \right]^{1/2}}$$

↑  
media geometrica delle radici

ampl. per sintonizzazione



- circuito per il rumore



$$\frac{di_A^2}{df}$$

$$\frac{dJ_A^2}{df}$$

$$\frac{dJ_{nn}^2}{df} = \left[ \frac{4kT}{(R_i \parallel R)} + 2q(\sigma P + I_d) + \frac{di_A^2}{df} \right] (Z_f)^2 + \frac{dJ_A^2}{df}$$

a centro banda  $\gamma \approx 1$   $R \ll R_i$

$$\frac{dJ_{nn}^2}{df} = \left[ \frac{4kT}{R} + 2q(\sigma P + I_d) + \frac{di_A^2}{df} \right] R^2 + \frac{dJ_A^2}{df}$$

$$J_{nn}^2 = 4kTBR + [2q(\sigma P + I_d)B + i_A^2] R^2 + J_A^2$$

power  $\frac{di_A^2}{df} = 2qI_A$  (current equiv.)

$$R_A^2 = \frac{J_A^2}{i_A^2} \quad (\text{unitate f/Hz})$$

$$J_{nn}^2 = 4kTBR + 2q[\sigma P + I_d + I_A(1 + R_A^2/R^2)]BR^2$$

- cifra di rumore

$$F_A^2 = \frac{\text{rumore totale}}{\text{rumore dovuto alle sole } \sigma_P + \bar{I}_d} =$$

$$= 1 + \frac{4kTB/R + i_A^2 + j_A^2/R^2}{2q(\sigma_P + \bar{I}_d)B}$$

$$= 1 + \frac{[(2kT/q)R + I_A(1 + R_A^2/R^2)]}{\sigma_P + \bar{I}_d}$$

regime quantico di rivelazione

$$I_{pho} = \frac{50mV}{R} + \left(1 + \frac{R_A^2}{R^2}\right) \bar{I}_A$$