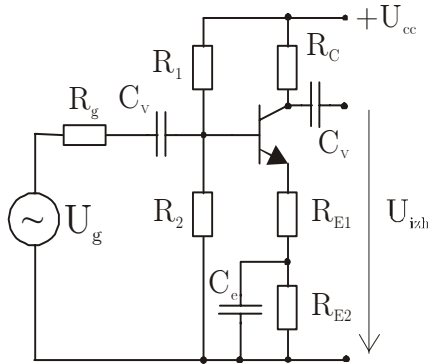


Komunikacijska vezja - rešitve nalog 4.2.2004

1. Izračunajte spodnjo mejno frekvenco in napetostno ojačenje pri srednjih frekvencah !



$$\text{Par}(R1, R2) := \frac{R1 \cdot R2}{R1 + R2}$$

$$R1 := 40000 \quad R_C := 10000$$

$$R2 := 4000 \quad R_{E1} := 200$$

$$C_e := 10 \cdot 10^{-6} \quad R_{E2} := 1000$$

$$C_v := 4 \cdot 10^{-6} \quad R_g := 3000$$

$$\beta := 100 \quad U_{cc} := 20 \quad U_{be0} := 0.6$$

$$R_B := \text{Par}(R1, R2) \quad R_B = 3.636 \cdot 10^3$$

$$I_e := \frac{U_{cc} \cdot \frac{R2}{R1 + R2} - U_{be0}}{R_{E1} + R_{E2} + \frac{R_B}{\beta + 1}} \quad I_e = 9.856 \cdot 10^{-4} \quad g_m := 40 \cdot I_e \quad r_{be} := \frac{\beta}{g_m}$$

$$R_{vh} := \text{Par}(R_B, r_{be} + R_{E1} \cdot \beta) \quad g_m = 0.039 \quad r_{be} = 2.537 \cdot 10^3$$

$$R_{vh} = 3.131 \cdot 10^3$$

$$A_0 := \left(g_m \cdot R_C \cdot \frac{r_{be}}{r_{be} + \beta \cdot R_{E1}} \right) \cdot \frac{R_{vh}}{R_{vh} + R_g} \quad A_0 = 22.661$$

$$R_{nv} := (\text{Par}(R_B, r_{be} + (R_{E1} + R_{E2}) \cdot \beta + r_{be})) + R_g \quad R_{nv} = 6.534 \cdot 10^3$$

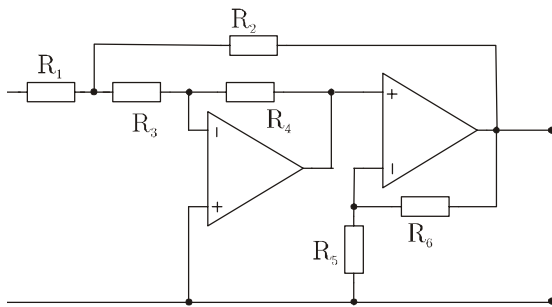
$$R_{ne} := \text{Par}(R_{E2} \cdot \beta, R_{E1} \cdot \beta + r_{be} + \text{Par}(R_B, R_g)) \quad R_{ne} = 1.947 \cdot 10^4$$

$$f_{pv} := \frac{1}{2 \cdot \pi \cdot R_{nv} \cdot C_v} \quad f_{pv} = 6.09$$

$$f_{pe} := \frac{\beta + 1}{2 \cdot \pi \cdot C_e \cdot R_{ne}} \quad f_{pe} = 82.553$$

$$f_{ne} := \frac{1}{2 \cdot \pi \cdot R_{E2} \cdot C_e} \quad f_{ne} = 15.915$$

2. Izračunajte vhodno upornost in napetostno ojačenje vezave na sliki !



$R1 := 1000$ $R2 := 10000$
 $R3 := 1000$ $R4 := 10000$
 $R5 := 1000$ $R6 := 10000$
 $A1 := 50$ $A2 := 50$

$$T1 := A1 \cdot \frac{R3}{R3 + R4} \quad Aoz1 := \frac{R4}{R3 + R4} \cdot A1$$

$$T1 = 4.545 \quad Aoz1 = 45.455$$

$$A\beta1 := \frac{Aoz1}{1 + T1} \quad A\beta1 = 8.197$$

$$Rv1 := R3 + \frac{R4}{1 + A1} \quad Rv1 = 1.196 \cdot 10^3$$

$$T := \frac{\text{Par}(R1, Rv1)}{\text{Par}(R1, Rv1) + R2} \cdot A\beta1 \cdot A\beta2 \quad T = 3.817$$

$$T2 := A2 \cdot \frac{R5}{R5 + R6} \quad Aoz2 := A2$$

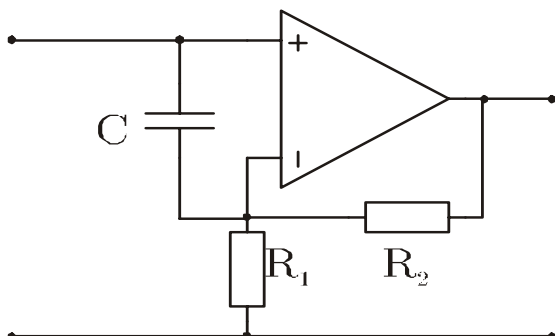
$$T2 = 4.545 \quad Aoz2 = 50$$

$$A\beta2 := \frac{Aoz2}{1 + T2} \quad A\beta2 = 9.016$$

$$Aoz := \frac{\text{Par}(R2, Rv1)}{R1 + \text{Par}(R2, Rv1)} \cdot (A\beta1 \cdot A\beta2) \quad Aoz = 38.173 \quad A\beta := \frac{Aoz}{1 + T} \quad A\beta = 7.924$$

$$Rvh := R1 + \frac{R2}{1 + A\beta1 \cdot A\beta2} \quad Rvh = 1.134 \cdot 10^3$$

2. Izračunajte fazno varnost in zgornjo mejno frekvenco ojačevalnika !



$$R1 := 10000 \quad R2 := 90000$$

podatki o ojačevalniku:

$$A0 := 10^5 \cdot \sqrt{10} \quad C := 500 \cdot 10^{-9}$$

$$fp1 := 3 \cdot 10^6 \quad fp2 := 30 \cdot 10^6$$

$$T0 := A0 \cdot \frac{R1}{R1 + R2} \quad T0 = 3.162 \cdot 10^4$$

$$f_{pk} := \frac{1}{2 \cdot \pi \cdot C \cdot \text{Par}(R1, R2)} \quad f_{pk} = 35.368$$

$$f_{zg} := T0 \cdot f_{pk} \quad f_{zg} = 1.118 \cdot 10^6$$

$$\Phi_m := 180 - \left(\frac{180}{\pi} \cdot \text{atan} \left(\frac{f_{zg}}{f_{pk}} \right) + \frac{180}{\pi} \cdot \text{atan} \left(\frac{f_{zg}}{fp1} \right) + \frac{180}{\pi} \cdot \text{atan} \left(\frac{f_{zg}}{fp2} \right) \right)$$

$$\Phi_m = 67.421 \quad 90 - \frac{180}{\pi} \cdot \text{atan} \left(\frac{f_{zg}}{fp1} \right) = 69.554$$