GEBZE TEKNİK ÜNİVERSİTESİ- MÜHENDİSLİK FAKÜLTESİ

ELEKTRONİK MÜHENDİSLİĞİ

ELM 331 – Elektronik II

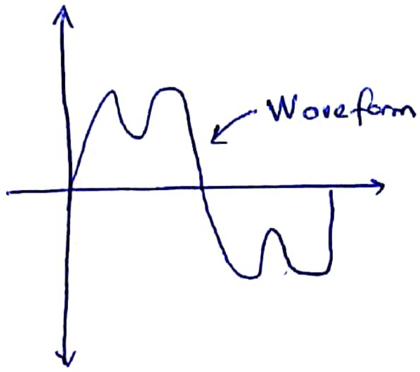
Bonus Ödevler

Mete Can GAZİ

141024020

Homework Bonus 3 : THD (total harmonic distribution) nedir? THD katsayıları nelerdir?

Distorted Waveform :



For example :

60Hz is fundamentals waveform.

2^{nd} harmonic component 120Hz

3^{rd} " " 180Hz

4^{th} " " 240Hz

⋮

For Volt(rms) ⟶ $THD = \dfrac{\sqrt{\sum_{n=2}^{\infty} V_n^2}}{V_1} \cdot 100\ \%$

← other frequency Amplitude

V_1 ← Fundamentals Frequency' Amplitude

For Watt ⟶ $THD = \sqrt{\dfrac{\sum_{n=2}^{\infty} P_n}{P_1}} \cdot 100$

Note: $V_{rms} = \dfrac{V_{pk}}{\sqrt{2}}$

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Homework Bonus 4: CH12'den 2 zor soru

Soru 1 (Soru 75 - Design Problem): We wish to design the transimpedance amplifier depicted Fig 12.101 for a closed-loop gain of 1kΩ. Assume each transistor carries a collector bias current of 1 mA, $\beta = 100$, $V_A = \infty$ and RF is very large.

a) Determine the values of RC and RM for open-loop gain and an open loop gain output impedance of 500Ω.

b) Compute the required value of RF

c) Closed loop output/input impedance?

a) Open loop gain $= R_C (g_{m2} \cdot R_m)$

$= 20\,k\Omega$

$$g_{m2} = \frac{I}{V_T} = \frac{1\,mA}{26\,mV} = 38.5\,mS$$

$$R_C \cdot R_m = \frac{20\,k\Omega}{38.5\,mS} \Rightarrow \boxed{\begin{array}{l} R_M = 500\,\Omega \\ R_C = 1040\,\Omega \end{array}}$$

Open loop output impedance $= R_M$

$R_M = 500\,\Omega$

b) closed loop gain:

$$\frac{20\,k\Omega}{1 + \frac{20\,k\Omega}{R_F}} = 1\,k\Omega \quad \boxed{R_F = 1053\,\Omega}$$

c) Closed loop input impedance:

$$\frac{\frac{1}{38.5\,mS}}{1 + \frac{20\,k\Omega}{1050\,\Omega}} = \underline{\underline{1.3\,\Omega}}$$

output: $500\,\Omega \left(\frac{1}{20}\right) = \underline{\underline{25\,\Omega}}$

Soru 2 (Soru 76): Design the circuit illustraed in Fig. 12.105 for an open-loop voltage gain of 20, an open loop output impedance of 2kΩ, and a closed loop voltage gain of 4. Assume $\lambda = 0$, Is the solution unique?. If not, how should the circuit parameters be chosen to minimize power dissipation?

$$\text{open-loop voltage gain} = \frac{R_{D1}}{\frac{1}{g_{m1}} + R_1 // R_2} \cdot \left[g_{m2} (R_1 // R_2)\right] = 20$$

$$\text{close-loop gain} = \frac{20}{1 + 20 \underbrace{\left(\frac{R_2}{R_1+R_2}\right)}_{\text{voltage divide}}} = 4 \longrightarrow \frac{R_2}{R_1+R_2} = 0.2$$

$$0.2R_1 + 0.2R_2 = R_2$$

$$R_1 + R_2 = 2k\Omega$$

$$R_2 = 0.4k\Omega \quad R_1 = 1.6k\Omega$$

$$\frac{R_{D1}}{\frac{1}{g_{m1}} + 2k\Omega} \left[g_{m2} \times 320\Omega\right] = 20$$

$$\frac{g_{m1} R_{D1}}{1 + 2k\Omega \cdot g_{m1}} \times g_{m2} = 0.0625$$

$$\boxed{g_{m1} = g_{m2}} = 20mS$$

$$R_{D1} = 6400\Omega = 6.4k\Omega$$

Scanned by CamScanner

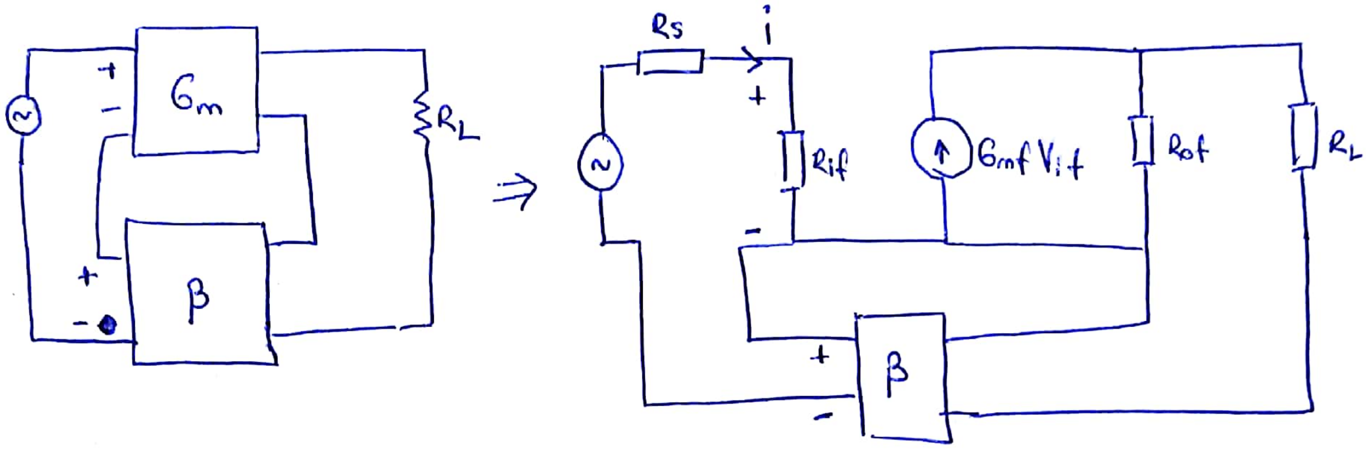
Homework Bonus 5: Which type of feedback is good for which type amplifier? Answer with explanation?

Pozitif feedback sistemlerinde gain çok yüksektir. Kuracağımız sistemde band genişliğinden çok kazanç önemli ise, bu tip yükseltgeçlere pozitif feedback eklenmelidir.

Negatif feedback sistemlerinde gain düşük olmasına rağmen band genişliği yüksektir ve bunun yanında devre daha stabildir. Sistemlerimizde bu özelliklere ihtiyaç varsa yükselteç'e negative feedback eklenmelidir.

Homework Bonus 6:

1) Current - Series Feedback



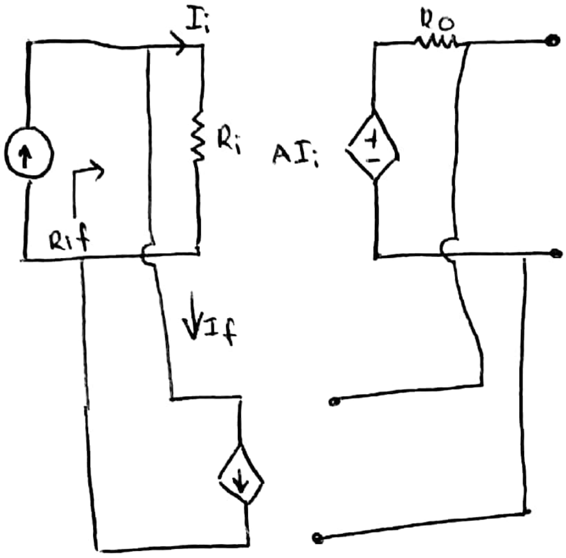
$$G_{mf} = \left.\frac{i_o}{V_{if}}\right|_{R_L=0} = \frac{i_o}{v_i + v_f} = \frac{G_m v_i}{(1+\beta G_m)v_i} = \frac{G_m}{1+\beta G_m}$$

$$R_{if} = \left.\frac{V_{if}}{i_i}\right|_{R_L=0} = \frac{v_i + v_f}{i_1} = \frac{(1+\beta G_m)v_i}{i_1} = (1+\beta G_m)R_i$$

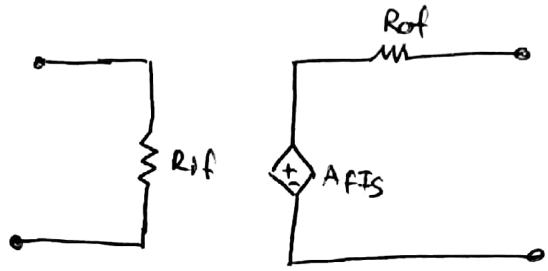
$$R_{of} = \left.\frac{V_o}{i_o}\right|_{R_L=V_o,\ V_{if}=0} = \frac{i_1 . R_o}{i_o} = \frac{(i_o + G_m v_i)R_o}{i_o} = \frac{(i_o + G_m \beta i_o).R_o}{i_o}$$

$$R_{of} = (1+\beta G_m)R_o$$

2) Shunt - Shunt Configration



$\Rightarrow$

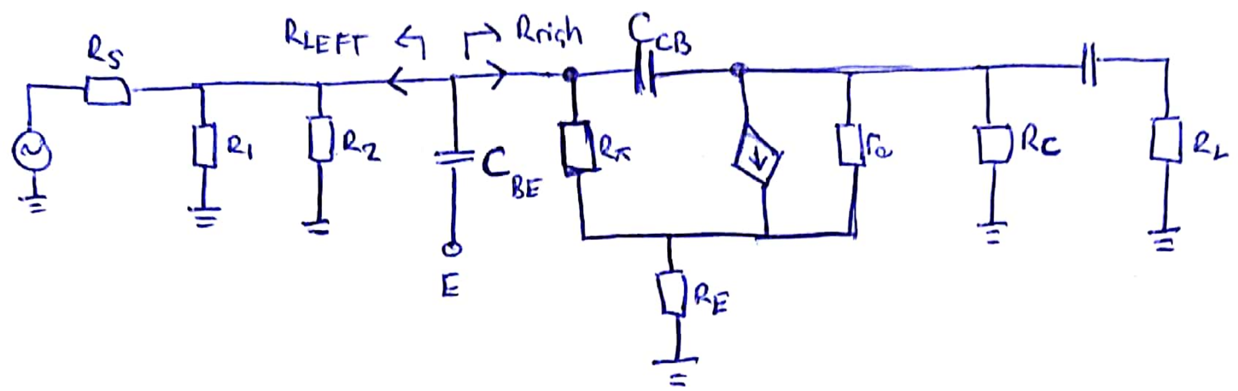


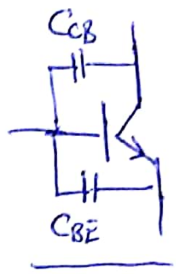
$$A_f = \frac{V_o}{I_s} = \frac{A}{1+A\beta}$$

$$R_{if} = R_i / (1+A\beta)$$

$$R_{of} = R_o / (1+A\beta)$$

Homework Bonus 7: CE amplifier with OCTC





miller effect

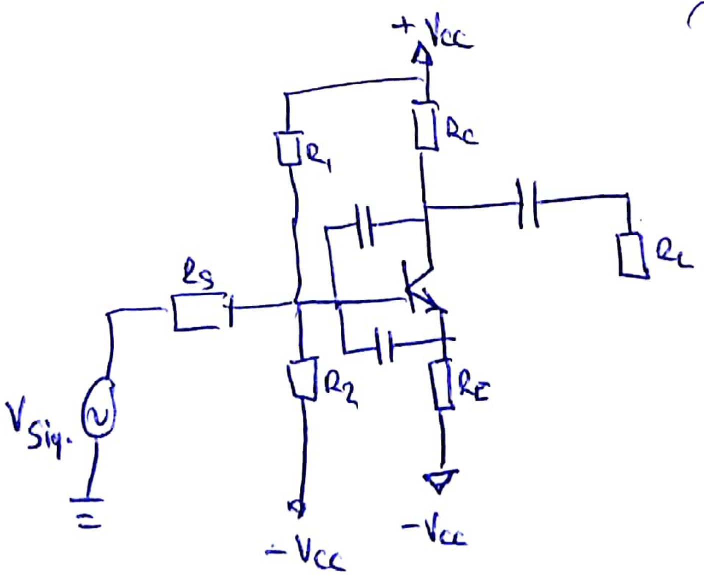
C_{BE} sees $\longrightarrow$ $\underbrace{R_1 // R_2 + R_S}_{R_{EEFT}} + \underbrace{R_E . R_C + r_o . R_E \left(1 + g_m r_\pi\right)}_{R_{right}}$ → using derivations documents

$\tau_{CBE} = C_{BE} \cdot R_{CBE}$

C_{CB} sees $\longrightarrow \left[R_S + R_1 // R_2\right] + \left[R_C // \left(r_o + R_E\right)\right]$

$\tau_{CCB} = C_{CB} \cdot R_{CCB}$

$$\boxed{\omega_H = \frac{1}{\tau_{CCB}} + \frac{1}{\tau_{CBE}}}$$



High Frequency Responce