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Session 17
Amplifiers with BJT transistors - Exercises

Electronic Components and Circuits

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Amplifiers with BJT transistors

OBJECTIVES

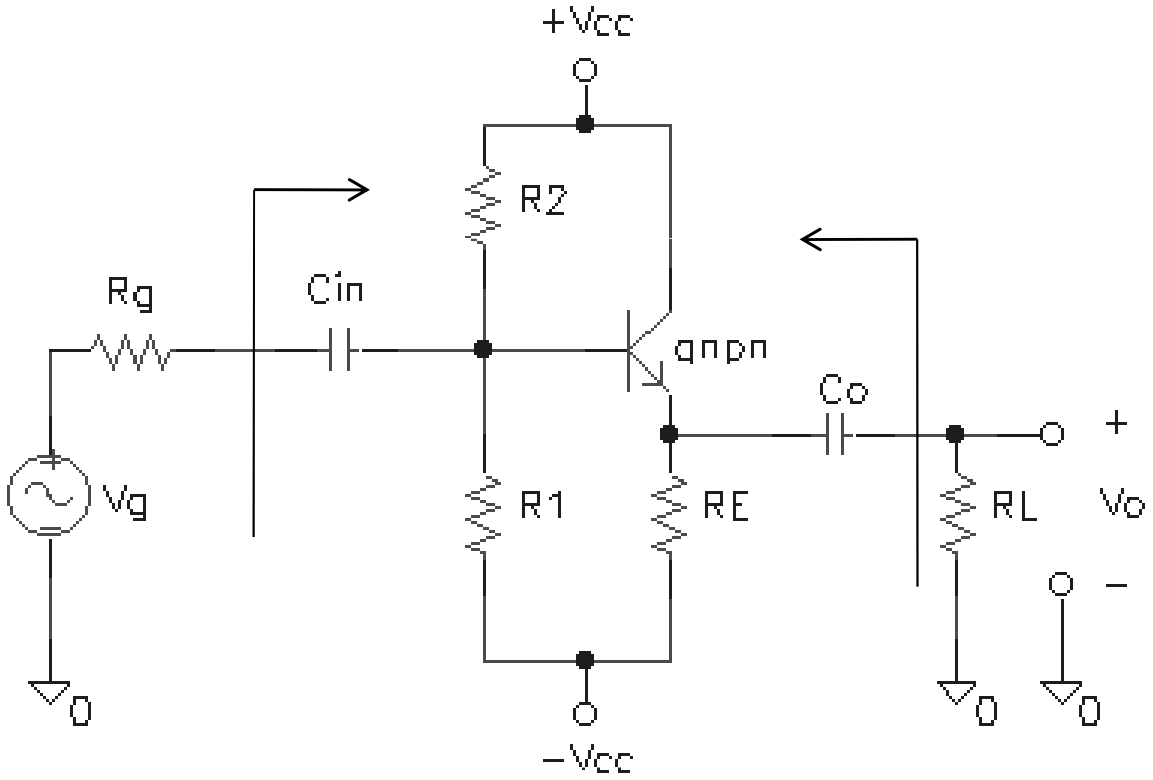
- To analyze small-signal equivalent circuits and interpret the characteristics of the amplifier
- To obtain gains: voltage gain, current gain, transconductance.
- To obtain input impedances.
- To obtain output impedances.

Small signal analysis of amplifier circuits

METHODOLOGY

1. Analyze / design the bias circuit (DC).
2. Represent the small signal equivalent circuit of the devices with external signal sources.
3. Obtain the most important gain characteristics of the amplifier.
4. Replace the signal generator with an ideal test generator to calculate the input impedance.
5. Cancel independent signal sources and connect an ideal test generator to calculate the output impedance.

Exercise: Practical circuit



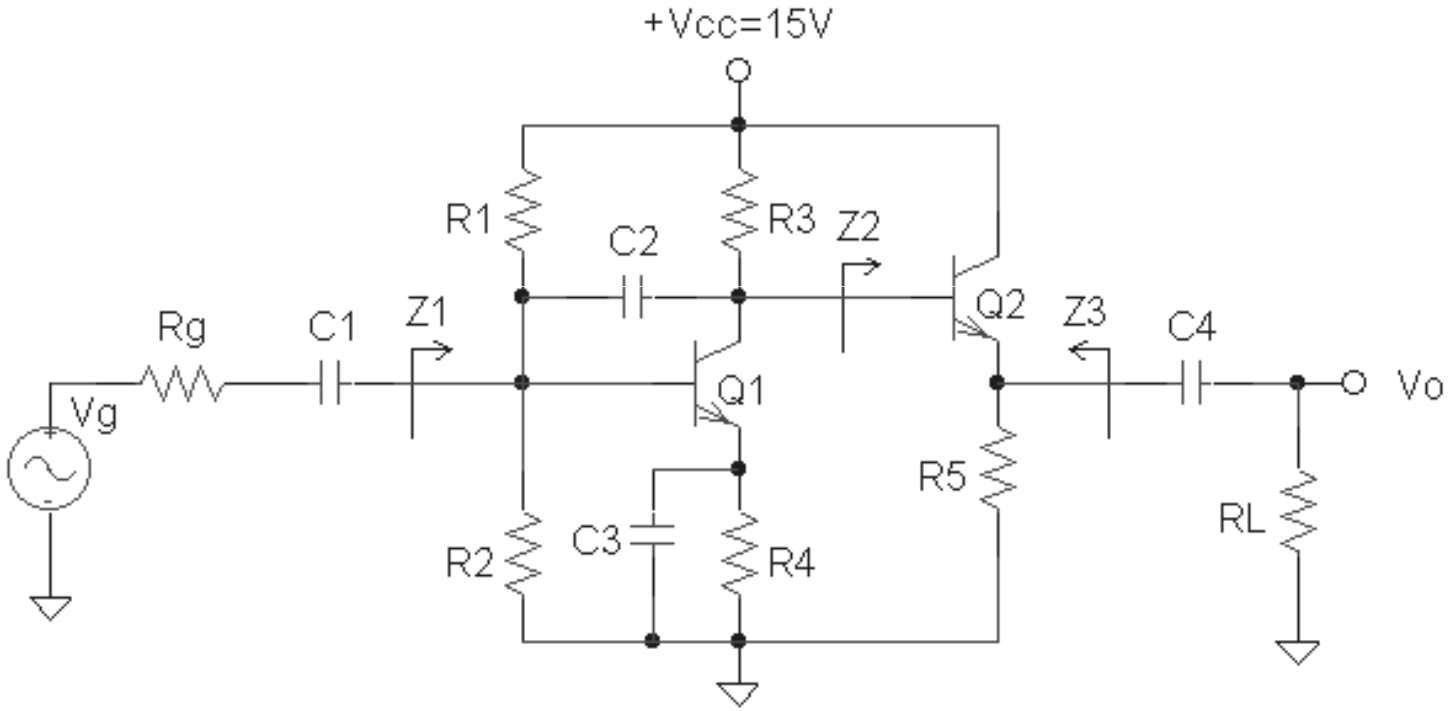
- What kind of amplifier is?
- Obtain the gain Vo/Vg
- Obtain the input impedance
- Obtain the output impedance

EXAMPLE

- Vcc = 12 V
- $I_C \cong 1$ mA
- $V_E \approx 0$ V (DC)
- $R_1=R_2=180K\Omega$
- R_E=?
- $R_L \cong 1K\Omega$
- $R_g = 50\Omega$
- $C_{in} = 10\mu F$
- $C_o = 100\mu F$
- Q_1 = BC547B

($\beta_F \approx \beta o \approx 300$)
($V_{BE\text{-}ON} = 0{,}7$ V)
($V_{CE\text{-}sat} = 0{,}2$ V)

Exercise: Two DC coupled transistors



Rg = 5 KΩ; R1 = 30 KΩ; R2 = 15 KΩ; R3 = 10KΩ; R4 = 8,8 KΩ; R5 = R_L = 4,7 KΩ

C1, C3 → ∞; C2 = 2,5 pF; C4 = 20 μF V_T = 25 mV

$\beta_F = \beta_0$ = 200; $r_o \rightarrow \infty$; $C\mu_1$ = 0,5 pF; $C\pi 1 = C\pi 2 = C\mu 2$ = 0 pF

- Draw the equivalent circuit for midrange frequency.
- Calculate the impedances Z1, Z2 and Z3.
- Replace Q2 by the impedance Z2 and calculate the gain of Q1.
- Calculate the total gain Vo/Vg.