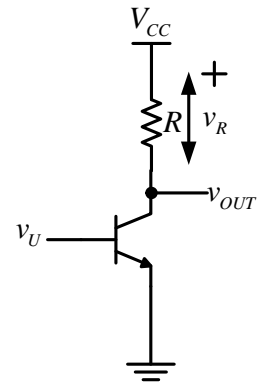


Zadatak: Napon na izlazu pojačavača snage u klasi A sa slike iznosi

$$v_{OUT} = v_{CE} = V_{CEQ} + k \frac{V_{CC}}{2} \Pi(t)$$

gde je

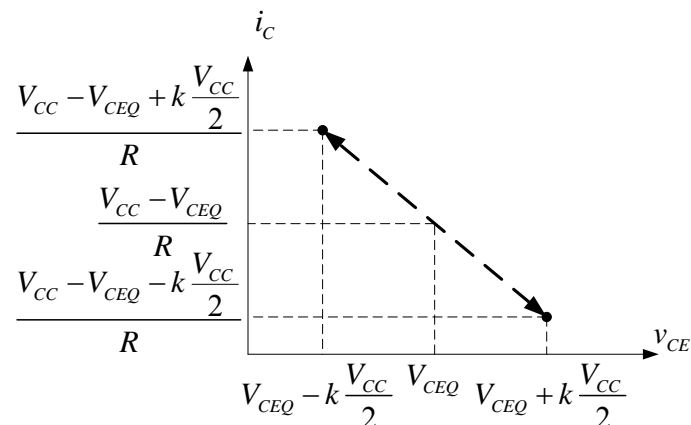
$$\Pi(t) = \begin{cases} 1, & nT < t < (2n+1)\frac{T}{2} \\ -1, & (2n+1)\frac{T}{2} < t < (n+1)T \end{cases}$$



- Nacrtati putanju radne tačke i odrediti disipacije tranzistora i potrošača u mirnoj radnoj tački.
- Odrediti i nacrtati vremenske oblike napona v_R , struje i_C , i snaga p_D , p_{OUT} i p_{CC} .
- Izvesti izraze za koeficijent korisnog dejstva i stvarni koeficijent korisnog dejstva u zavisnosti od V_{CEQ} i k .
- Odrediti vrednost V_{CEQ} tako da se na izlazu može dobiti maksimalna amplituda neizobličenog napona. Kako tada glasi izraz za koeficijent korisnog dejstva? Kada je ovaj koeficijent maksimalan?
- Odrediti maksimalnu moguću vrednost k za koju se na izlazu dobija neizobličen signal, ako je $V_{CEQ} = \frac{3}{8}V_{CC}$. Kolike su tada minimalna i maksimalna vrednost napona na izlazu?

Rešenje:

a)

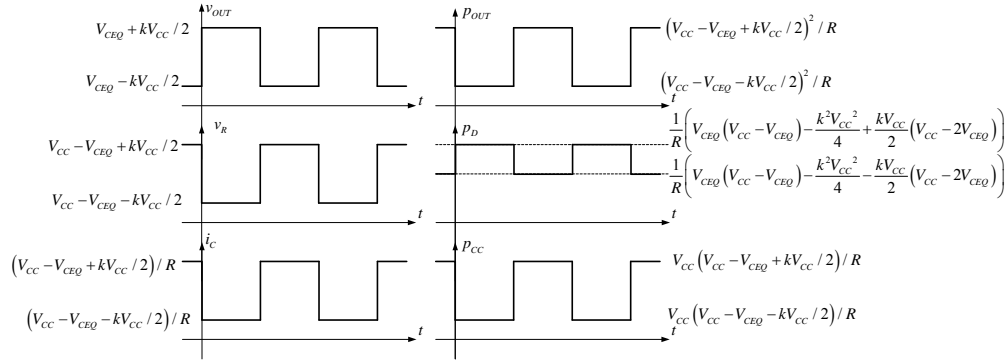


$$P_{DQ} = V_{CEQ} I_{CQ} = V_{CEQ} \frac{V_{CC} - V_{CEQ}}{R}$$

$$P_{OUTQ} = V_R I_{CQ} = (V_{CC} - V_{CEQ}) \frac{V_{CC} - V_{CEQ}}{R} = \frac{(V_{CC} - V_{CEQ})^2}{R} = P_{OUTDC}$$

b)

$$\begin{aligned}
 v_R &= V_{CC} - v_{CE} = V_{CC} - V_{CEQ} - k \frac{V_{CC}}{2} \Pi(t) \\
 i_C &= \frac{v_R}{R} = \frac{V_{CC} - V_{CEQ}}{R} - k \frac{V_{CC}}{2R} \Pi(t) \\
 P_{OUT} &= \frac{v_R^2}{R} = \frac{1}{R} \left(V_{CC} - V_{CEQ} - k \frac{V_{CC}}{2} \Pi(t) \right)^2 \\
 P_D &= v_{CE} i_C = \frac{1}{R} \left(V_{CEQ} + \frac{kV_{CC}}{2} \Pi(t) \right) \left(V_{CC} - V_{CEQ} - \frac{kV_{CC}}{2} \Pi(t) \right) = \\
 &= \frac{1}{R} \left(V_{CEQ} (V_{CC} - V_{CEQ}) - \frac{k^2 V_{CC}^2}{4} \right) + \frac{kV_{CC}}{2R} (V_{CC} - 2V_{CEQ}) \Pi(t) \\
 P_{CC} &= V_{CC} i_C = \frac{V_{CC} (V_{CC} - V_{CEQ})}{R} - k \frac{V_{CC}^2}{2R} \Pi(t)
 \end{aligned}$$



c)

$$\begin{aligned}
 P_{OUT} &= \overline{P_{OUT}} = \frac{1}{R} \overline{\left(V_{CC} - V_{CEQ} - k \frac{V_{CC}}{2} \Pi(t) \right)^2} = \\
 &= \frac{1}{R} \overline{\left(V_{CC} - V_{CEQ} \right)^2 + \frac{k^2 V_{CC}^2}{4} - kV_{CC} (V_{CC} - V_{CEQ}) \Pi(t)} = \\
 &= \frac{1}{R} \left(\left(V_{CC} - V_{CEQ} \right)^2 + \frac{k^2 V_{CC}^2}{4} - kV_{CC} (V_{CC} - V_{CEQ}) \overline{\Pi(t)} \right) = \frac{1}{R} \left(\left(V_{CC} - V_{CEQ} \right)^2 + \left(\frac{kV_{CC}}{2} \right)^2 \right) = \\
 &= P_{OUTDC} + P_{OUTAC}
 \end{aligned}$$

$$\begin{aligned}
 P_D &= \overline{P_D} = \frac{1}{R} \overline{\left(V_{CEQ} (V_{CC} - V_{CEQ}) - \frac{k^2 V_{CC}^2}{4} + \frac{kV_{CC}}{2R} (V_{CC} - 2V_{CEQ}) \Pi(t) \right)} = \\
 &= \frac{1}{R} \left(V_{CEQ} (V_{CC} - V_{CEQ}) - \frac{k^2 V_{CC}^2}{4} \right)
 \end{aligned}$$

$$P_{CC} = p_{CC} = \frac{V_{CC}(V_{CC} - V_{CEQ})}{R} - k \frac{V_{CC}^2}{2R} \Pi(t) = \frac{V_{CC}(V_{CC} - V_{CEQ})}{R}$$

$$\eta = \frac{P_{OUT}}{P_{CC}} = \frac{(V_{CC} - V_{CEQ})^2 + \left(k \frac{V_{CC}}{2}\right)^2}{V_{CC}(V_{CC} - V_{CEQ})}$$

$$\eta_{AC} = \frac{P_{OUTAC}}{P_{CC}} = \frac{\left(k \frac{V_{CC}}{2}\right)^2}{V_{CC}(V_{CC} - V_{CEQ})}$$

d)

$$V_{CEQ} = \frac{V_{CC}}{2}$$

$$\eta = \frac{P_{OUT}}{P_{CC}} = \frac{1+k^2}{2}$$

$$\eta_{AC} = \frac{P_{OUTAC}}{P_{CC}} = \frac{k^2}{2}$$

$$\eta_{ACmax} = \eta_{AC}(k=1) = \frac{1}{2}$$

e) Ovo se dešava ako MRT nije postavljena kako valja...

$$V_{CEQ} + k \frac{V_{CC}}{2} \leq V_{CC}; \quad k \leq 2 \frac{V_{CC} - V_{CEQ}}{V_{CC}}$$

$$V_{CEQ} - k \frac{V_{CC}}{2} \geq 0; \quad k \leq 2 \frac{V_{CEQ}}{V_{CC}}$$

$$k_{max} = \min \left\{ 2 \frac{V_{CEQ}}{V_{CC}}, 2 \frac{V_{CC} - V_{CEQ}}{V_{CC}} \right\} = \min \left\{ \frac{3}{4}, \frac{5}{4} \right\} = \frac{3}{4}$$

$$v_{OUTmax} = V_{CEQ} + k \frac{V_{CC}}{2} = \frac{3}{4} V_{CC}$$

$$v_{OUTmin} = V_{CEQ} - k \frac{V_{CC}}{2} = 0$$