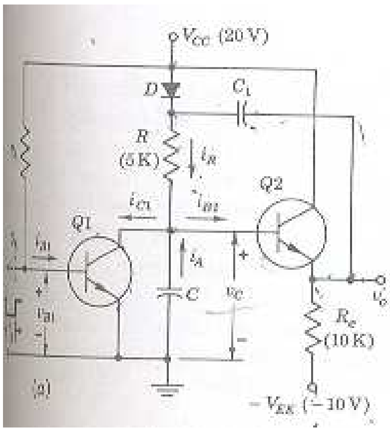
Problem:

The circuit given figure has the following parameters:
$V_{CC} = 20V, V_{EE} = 10V, R_e = 10K, R = 5K and T_g = 700\mu\sec$. the transistor h-parameter values are $h_{ie} = 1.1K, h_{fe} = 50, \frac{1}{h_{oe}} = 40K$. a 20V sweep in 500μsec is desired.



(a) find a reasonable value for R_b (b) calculate C

(c) calculate return time (d) calculate sweep error

(e) calculate the recovery time T_1 for C_1 to recharge completely.

Solution:

(a) from equation(1) , $R_b \le h_{FE} R$ = 250 K

hence, a reasonable value for R_b is 100 K

(b) since $T_S = 500 < T_g = 700\mu\sec$, then equation (3) is valid,

and $C = \frac{T_S}{R} = \frac{500}{5000} = 0.1\mu F$

(c) from equation (4),

$$T_r = \frac{CV_S}{V_{CC}\left[\frac{h_{FE}}{R_B} - \frac{1}{R}\right]} = 333\mu\text{sec}$$

(d) we know for bootstrap sweep circuit,

$$e_S = \frac{V_S}{AV_{CC}}\left(\frac{R}{R_i} + (1-A)\right)$$

Here $A = 1 - \frac{h_{ie}}{R_i}$ $R_i = h_{ie} + A_I R_L$

And $A_I = \frac{1+h_{FE}}{1+h_{oe}R_L}$

Here $R_L = R_e$

By substituting all the values , $A_I = 40.8, R_i = 409K, A = 0.9973$

And $e_S = 0.0149$

(e) from equation(5) , $T_1 = \frac{V_{CC}}{V_{EE}} \frac{R_e}{R} T$

$$T_1 = \frac{20}{10}\frac{10}{5}(700 + 333) = 4{,}130\mu\sec$$

Current Time-Base Generators:

We have mentioned earlier that Current time base generator is one that provides an Out put current waveform a portion of which exhibits a linear variation of current with time.

A linearly varying current waveform can be generated by applying a constant a constant Voltage across an inductor.(if inductor is an ideal one)

We know voltage across an inductor is $V = L\frac{di(t)}{dt}$

So $i(t) = \frac{1}{L}\int V dt$

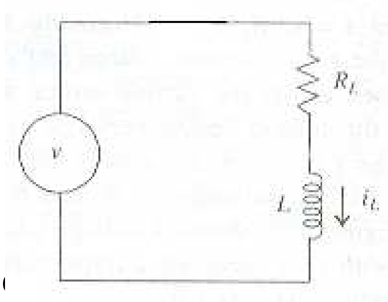
If V is constant then $i(t) = \frac{V}{L}t = \alpha t$

Hence $i(t)$ varies linearly with time.

But practically every inductor offers some resistance . so there is a need to apply **trapezoidal voltage** across it to produce current sweeps.

Consider R_L is the resistance offered by the inductor L .

Then voltage across practical inductor is



$$V = R_L i(t) + L\frac{di(t)}{dt}$$

If $i(t) = \alpha t$ then $V = R_L \alpha t + L\alpha$

So $V = A + Bt$

Where A= $L\alpha$ and B= αR_L

Hence trapezoidal voltage is essential to produce current sweeps across an practical inductor.