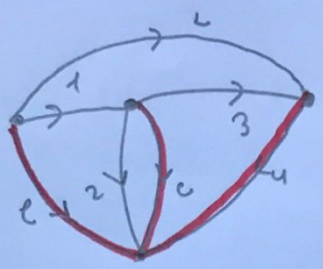
Graf



$T = \{e, C, 4\}$

① Stat variables $\begin{pmatrix} v_c \\ i_L \end{pmatrix}$

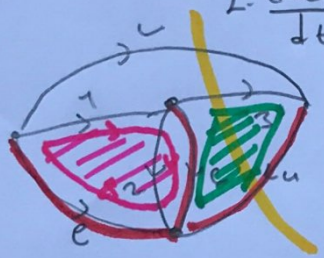
② $i_C + i_2 - i_1 + i_3 = 0$

$v_L + v_4 - e = 0$

③ $C \cdot \frac{dv_c}{dt} = i_1 - i_2 - i_3$

$L \cdot \frac{di_L}{dt} = e - v_4$

④



$v_3 = v_4 - v_c$

$i_4 - i_3 - i_L = 0$

$i_4 = i_3 + i_L$

$v_2 = v_c - e$

$v_2 = v_c$

⑤ $C \frac{dv_c}{dt} = G_1(v_c - e) - G_2 v_c - G_3(v_4 - v_c)$

$\frac{L di_L}{dt} = e - v_4$

$v_4 = ?$ $\quad i_4 = i_3 + i_L$

$v_4 = G_4 i_4 = G_4(i_3 + i_L)$

$= G_4(G_3 v_3 + i_L)$

$v_4 = G_4(G_3(v_4 - v_c) + i_L)$

$v_4 = G_4 G_3 v_4 - G_4 G_3 v_c + G_4 i_L$

$(1 - G_4 G_3) v_4 = -G_4 G_3 v_c + G_4 i_L$

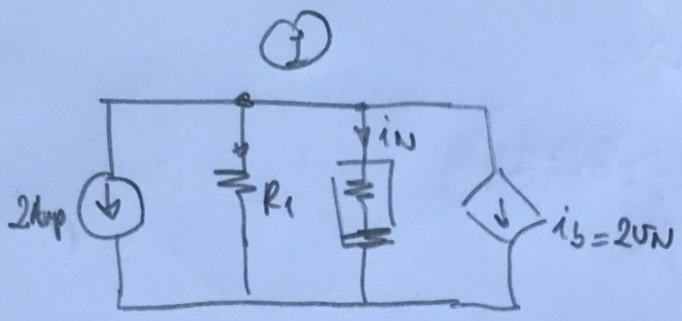
$v_4 = \frac{-G_4 G_3 v_c + G_4 i_L}{1 - G_4 G_3}$

$C \frac{dv_c}{dt} = G_1(v_c - e) - G_2 v_c - G_3\left(\frac{-G_4 G_3 v_c + G_4 i_L}{1 - G_4 G_3} - v_c\right)$

$\frac{L di_L}{dt} = e + \frac{G_4 G_3 v_c - G_4 i_L}{1 - G_4 G_3}$

(3)

Dc



$$① \rightarrow \quad +2 + i_{R1} + i_N + i_L = 0$$

$$2 + \frac{v_N}{R_1} + v_N^2 + 2v_N = 0$$

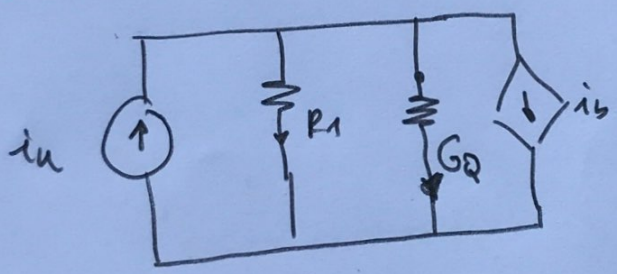
$$v_N^2 + 3v_N + 2 = 0$$

$$(v_N + 1)(v_N + 2) = 0$$

$$Q_1 = \{ v_N = -1, i_N = 1 \}.$$

$$Q_2 = \{ v_N = -2, i_N = 4 \}.$$

Ac



$$G_{Q1} = \frac{\partial v_N^2}{\partial v_N}\Big|_{Q1}$$

$$= 2v_N\Big|_{Q1}$$

$$= -2\ \mho$$

$$G_{Q2} = 2v_N\Big|_{Q2}$$

$$= -4\ \mho$$

Q_1 ken;

$$-i_{in} + i_{R1} + i_{GQ} + i_L = 0$$

$$-i_{in} + \frac{v_N}{1} + (-2)\cdot v_N + 2v_N = 0$$

$$v_N = 0{,}1 \sin \omega t$$

Q_2 kan

$$-i_{in} + \frac{v_N}{1} + (-4)\cdot v_N + 2v_N = 0$$

$$v_N = -0{,}1 \sin \omega t$$

Q_1 için $v_N = -1 + 0{,}1 \sin \omega t$ Q_2 için $v_N = -2 - 0{,}1 \sin \omega t$