EE302
02/01/05

$$\frac{G_c}{C} = -\frac{R_L}{L} \qquad G_c = -\frac{C}{L}R_L$$

$$R_C = -\frac{L}{CR_L}$$

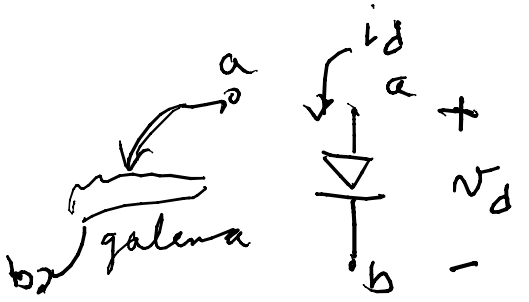
$$\frac{d}{dt}\begin{bmatrix} v_c \\ i_L \end{bmatrix} = \begin{bmatrix} -G_c/C & -1/C \\ 1/L & -R_L/L \end{bmatrix}\begin{bmatrix} v_c \\ i_L \end{bmatrix} \qquad x = \begin{bmatrix} v_c \\ i_L \end{bmatrix}$$

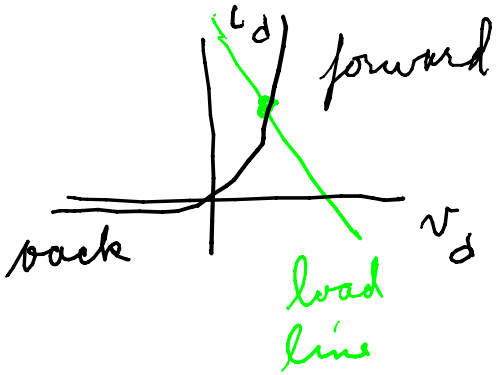
$$\frac{dx}{dt} = Ax \Rightarrow \frac{d}{dt}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}, \; x(0) \text{ given}$$

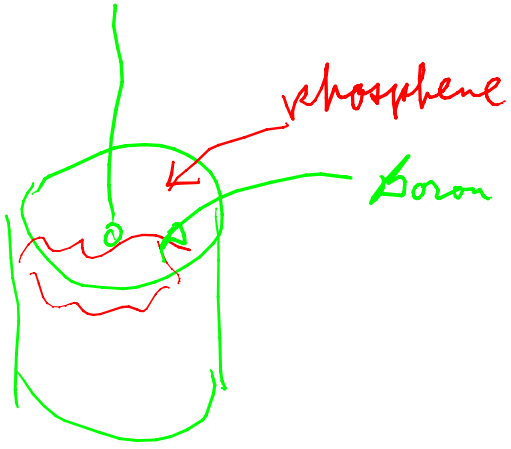
$$i_C = C\frac{dv_c}{dt} = C\frac{dx_1}{dt} = \underbrace{-\frac{G_c}{C}x_1}_{\text{currents}} \underbrace{-\frac{1}{C}x_2}_{} = \underbrace{\frac{C}{L}R_L\frac{1}{C}x_1}_{\text{current into capacitor}} \underbrace{-\frac{1}{C}x_2}_{\text{goes out}}$$

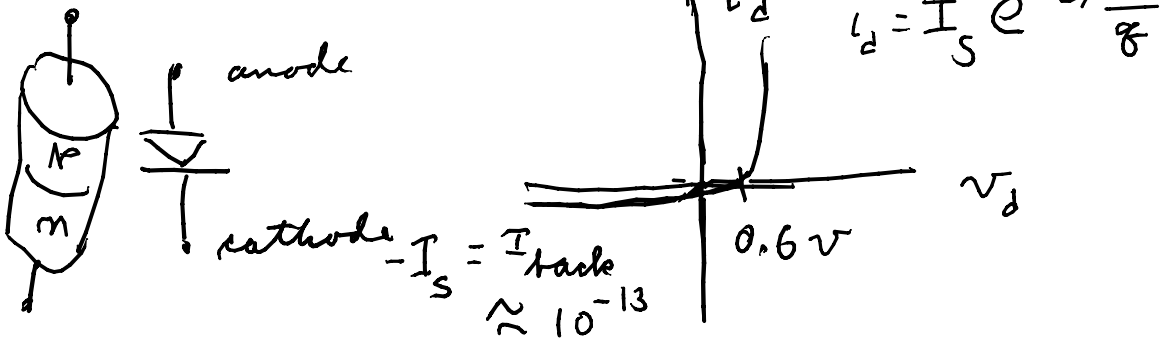
x_1 = voltage

diodes









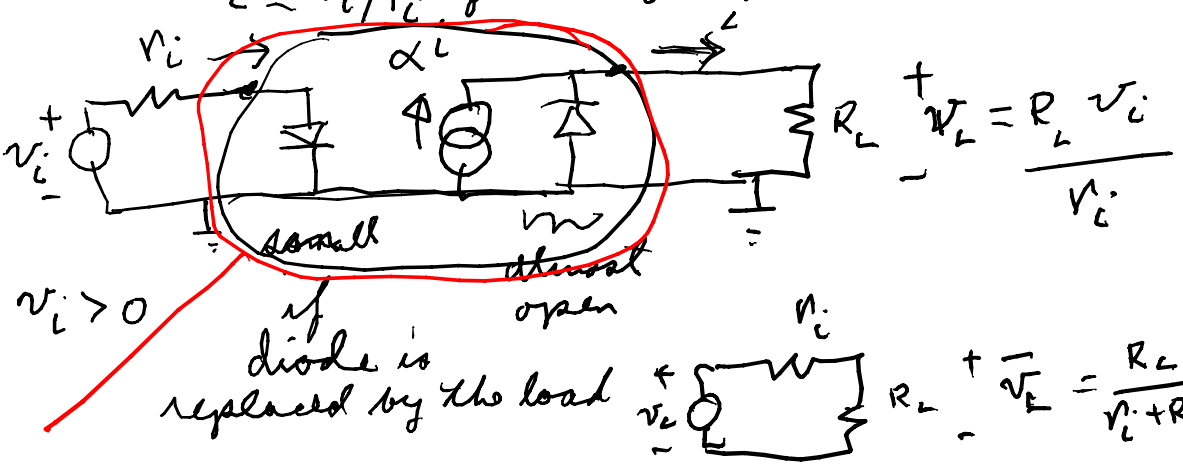
$-I_S$ = saturation current

V_T = thermal voltage = $\frac{kT}{q} \approx 26\,mV$ @ room Temp

$$i_d = I_S\left(e^{v_d/V_T} - 1\right)$$

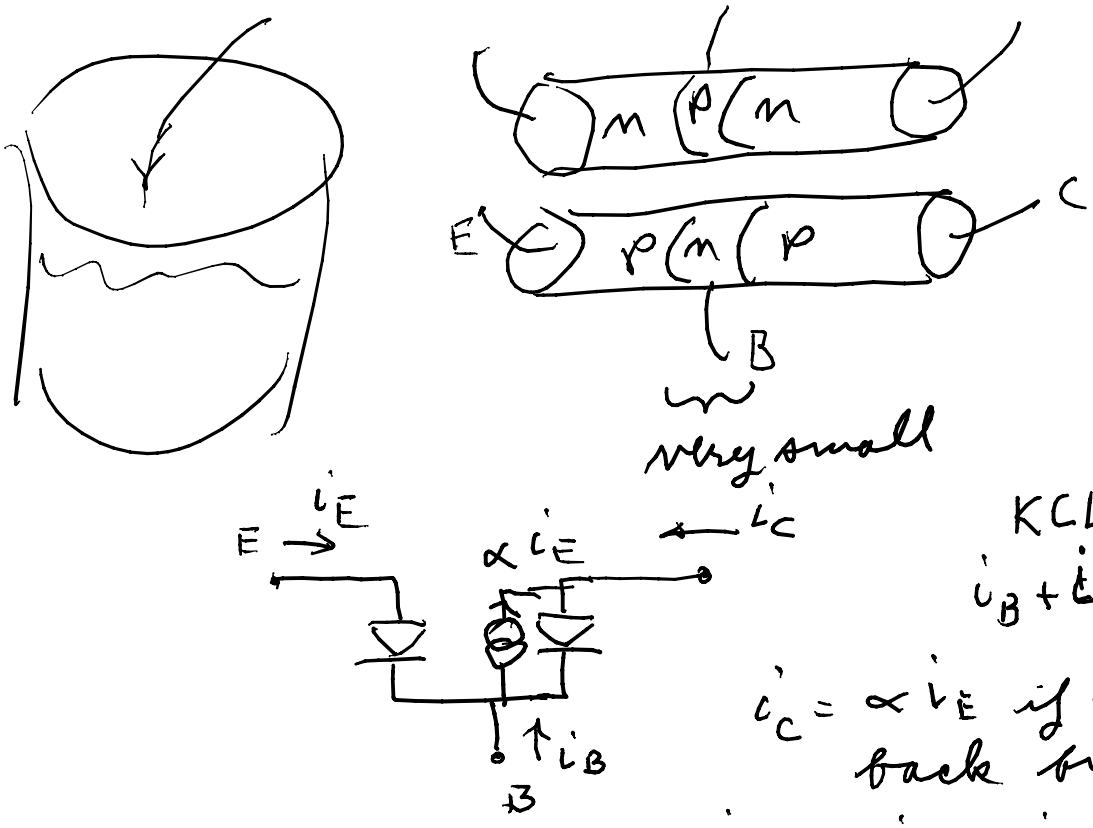
transistor = transfer resistor

$i \simeq v_i / r_i$ if diode forward resistance zero



a transistor

$\alpha \approx 1$, $0 < \alpha < 1$



KCL:

$$i_B + i_C + i_E = 0$$

$i_C = \alpha i_E$ if CB diode is forward biased

$$i_B = -i_E - \alpha i_E = -i_C - \frac{1}{\alpha} i_C$$

$$= -\left(\frac{\alpha - 1}{\alpha}\right) i_C$$

$$\therefore i_C = + \frac{\alpha}{1-\alpha} i_B \quad ; \quad \beta = \frac{\alpha}{1-\alpha}$$ large