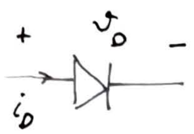
Diode Applications

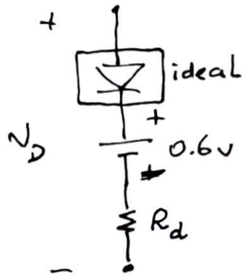


$$i_D = I_s\left(e^{v_D/v_{TH}} - 1\right)$$

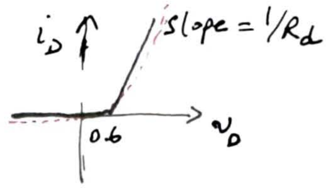
$$v_{TH} = \frac{kT}{q} \approx 0.025\,\text{v at room temperature.}$$

$$I_s \cong 10^{-12}\,A$$

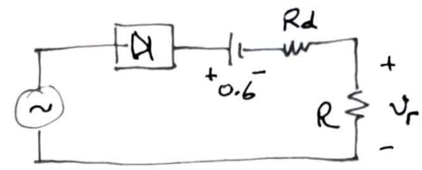
Generally modeled as:

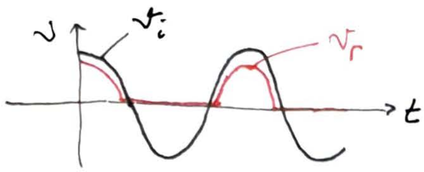


$\Rightarrow$

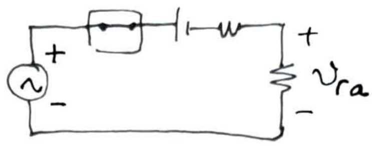


Half-rectifier circuit:



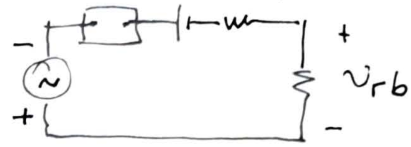


ON case:



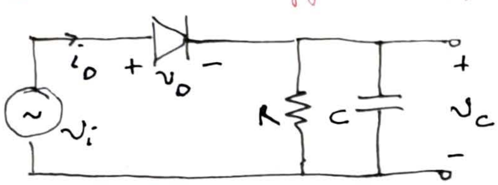
$$v_{ra} = (v_i - 0.6)\frac{R}{R+R_d}$$

OFF case:



$$v_{rb} = 0$$

* Non-linear analysis with RC (Peak-detector application)



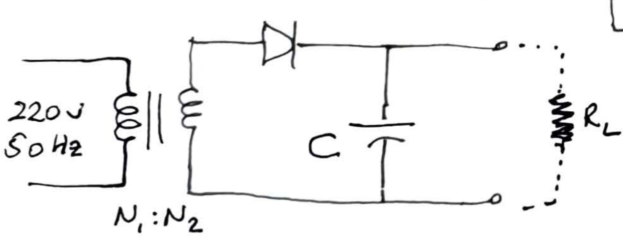
$v_i = V_p \cdot \sin\omega t$

$$i_D = \frac{v_c}{R} + C\frac{dv_c}{dt} \qquad v_D = v_i - v_c$$

$$i_D = I_s\left(e^{q(v_i - v_c)/kT} - 1\right)$$

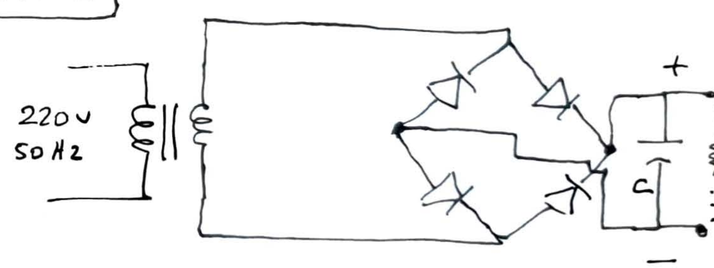
$$\frac{dv_c}{dt} = -\frac{v_c}{RC} + \frac{I_s}{C}\left[e^{q(v_i-v_c)/kT} - 1\right] \quad \text{state equation}$$

Half-wave rectifier (DC supply)



Recall transformers

Full-wave rectifier (DC supply)



peak_detector.py

1) sin(50Hz)
2) observe the effect of C and R_L
3) Try with a variable amplitude sine (can it track the peak?)
4) Find the point that it cannot track the peak well by playing with ω, C, R_L parameters.