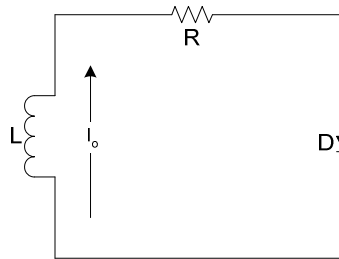


Recirculating diode equation

Circuit:



EE 12/6/2006

Basic equation based on Kirchhoff's voltage law:

$$V_L = V_D + V_R$$

Where¹:

$$V_L = L \times \frac{di}{dt}$$

$$V_R = i \times R$$

$$i_D = I_S \times \left(e^{\frac{V_D}{n \times V_T}} - 1 \right) \text{ solving for } V_D \text{ gives: } V_D = n \times V_T \times \ln \left(\frac{i_D}{I_S} + 1 \right)$$

Differential equation (first order; homogeneous; non-linear):

$$\frac{di}{dt} - \left[\frac{R}{L} \times i + \frac{n \times V_T}{L} \times \ln \left(\frac{i}{I_S} + 1 \right) \right] = 0$$

¹ The diode equation is from the Spice model; Ultimately, it will include an ohmic resistance component