MEDIDOR

DE

INDUCTORES

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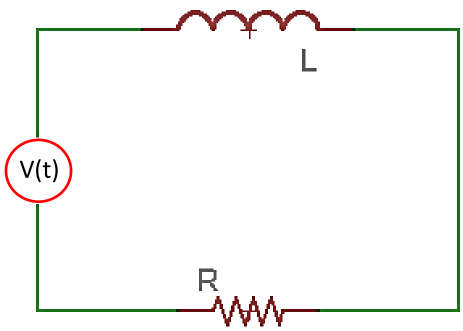
Primera aproximación considerando un inductor ideal:



$$V_L(t) = L\frac{di}{dt}$$

$$\begin{cases} L\,i'(t) + R\,i(t) = V(t) \\ i(0) = 0 \end{cases}$$

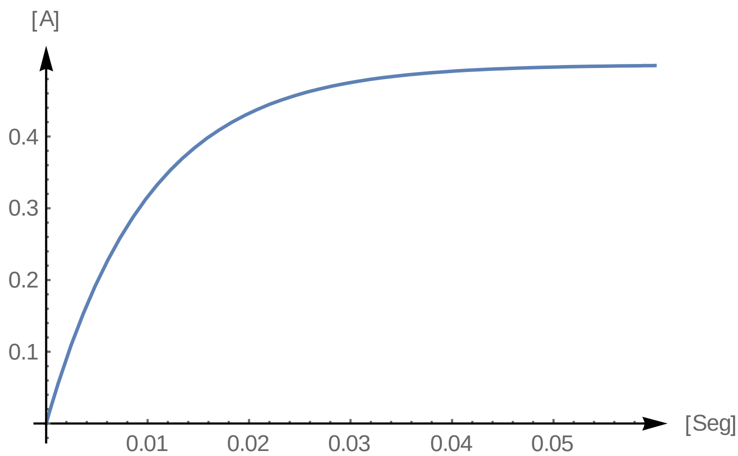
$$\boxed{i(t) = \frac{V}{R} - \frac{V\,e^{-\frac{R}{L}t}}{R} = \frac{V}{R}\left(1 - e^{-\frac{R}{L}t}\right) \quad [1]}$$

Damos valores aleatorios a los componentes a fin de ver la curva resultante:

R = 10 Ohm

V = 5 v

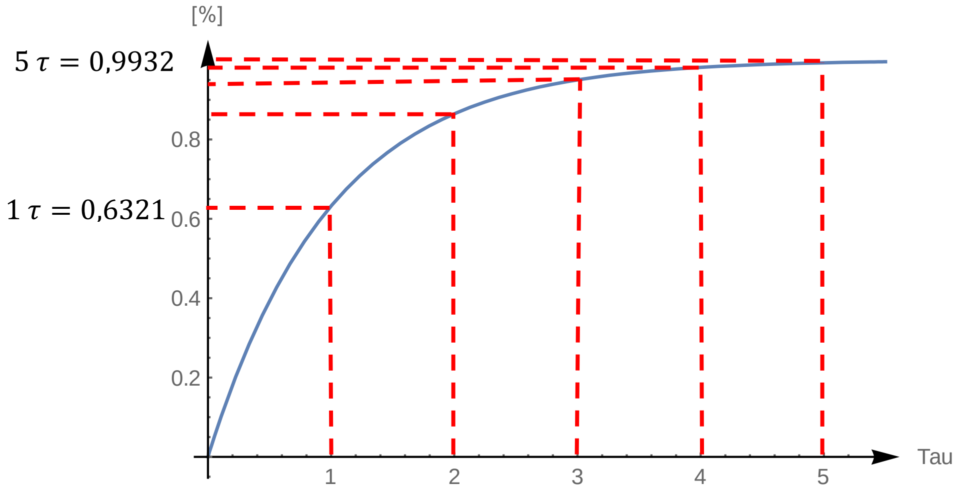
L = 0.1 Hy



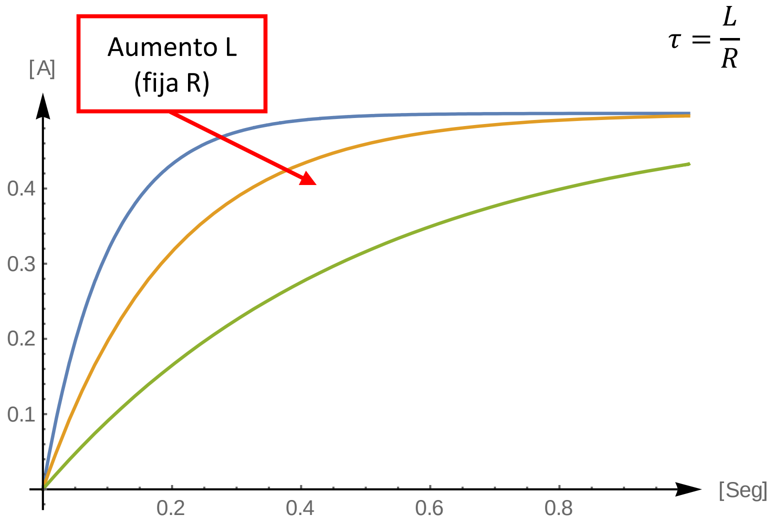
$$\boxed{\tau = \frac{L}{R} \quad [Seg]}$$

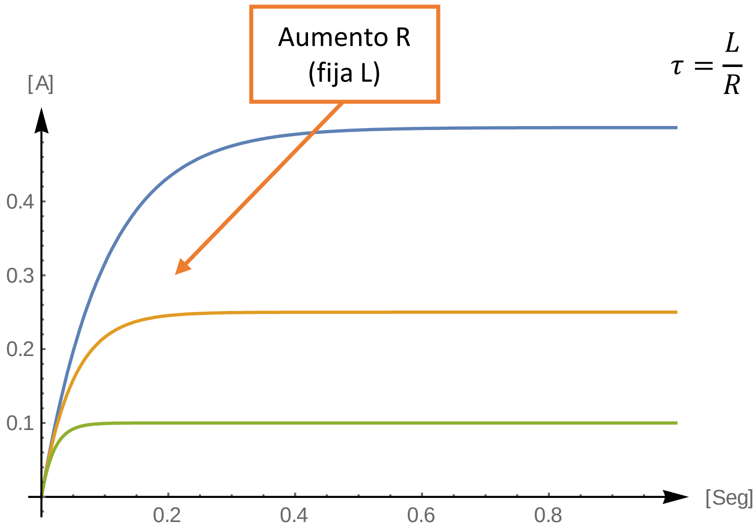
Reemplazamos τ en [1]:

$$i(t) = 1 - \frac{1}{e^{\frac{t}{\tau}}}$$



Analizamos la familia de curvas en función del valor de τ:





Multiplicamos m. a m. a [1] por “R”:

$$\underbrace{R\ i(t)}_{V_R(t)} = R\ \frac{V}{R}\left(1 - e^{-\frac{R}{L}t}\right)$$

$$V_R(t) = V\left(1 - e^{-\frac{R}{L}t}\right)$$

$$\frac{V_R}{V} = 1 - e^{-\frac{R}{L}t}$$

$$\frac{V_R}{V} - 1 = -e^{-\frac{R}{L}t}$$

$$1 - \frac{V_R}{V} = e^{-\frac{R}{L}t}$$

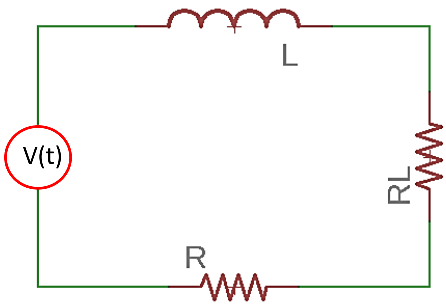
$$\ln\left(1 - \frac{V_R}{V}\right) = \ln\left(e^{-\frac{R}{L}t}\right)$$

$$\ln\left(1 - \frac{V_R}{V}\right) = \left(-\frac{R}{L}\ t\right)\underbrace{\ln(e^1)}_{=1}$$

$$-\frac{\ln\left(1-\frac{V_R}{V}\right)}{R\,t}=\frac{1}{L}$$

$$\boxed{L=-\frac{R\,t}{\ln\left(1-\frac{V_R}{V}\right)}}$$

Segunda aproximación considerando la R interna del inductor:



$$\begin{cases} L\,i'(t)+R\,i(t)+R_L\,i(t)=V(t) \\ i(0)=0 \end{cases}$$

$$i(t)=-\frac{V(t)\left(-1+e^{\frac{(-R-R_L)}{L}t}\right)}{R+R_L}\quad[2]$$

$$\underbrace{R\,i(t)}_{V_R(t)}=-\frac{V\left(-1+e^{\frac{(-R-R_L)}{L}t}\right)}{R+R_L}\,R$$

$$-\frac{V_R\,(R+R_L)}{V\,R}=-1+e^{\frac{(-R-R_L)}{L}t}$$

$$1-\frac{V_R\,(R+R_L)}{V\,R}=e^{\frac{(-R-R_L)}{L}t}$$

$$\ln\left(1-\frac{V_R\,(R+R_L)}{V\,R}\right)=\ln\left(e^{\frac{(-R-R_L)}{L}\,t}\right)$$

$$\ln\left(1-\frac{V_R\,(R+R_L)}{V\,R}\right)=\frac{(-R-R_L)}{L}\;t\;\ln(e^1)$$

$$\boxed{L=-\frac{(R+R_L)\,t}{\ln\left(1-\frac{V_R\,(R+R_L)}{V\,R}\right)}}$$