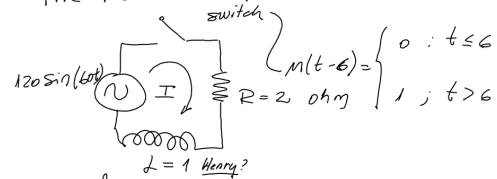


The Heaviside step function



$$L \frac{dI}{dt} + RI = u(t-6) \cdot 120 \sin(60(t-6))$$

$$I(0) = 0$$

$$L \left\{ \frac{dI}{dt} + 2I \right\} = L \left\{ u(t-6) \cdot 120 \sin(60(t-6)) \right\}$$

$$L \left\{ \frac{dI}{dt} \right\} + 2L \{ I \} = 120 L \left\{ u(t-6) \sin(60(t-6)) \right\}$$

$$S \{ I \} - I(0) + 2L \{ I \} = 120 \left[\frac{60 e^{-6s}}{s^2 + (60)^2} \right]$$

$$(s+2) \{ I \} = \frac{120 \cdot 60 \cdot e^{-6s}}{s^2 + 3600}$$

$$\{ I \} = \frac{7200 \cdot e^{-6s}}{(s^2 + 3600)(s+2)}$$

$$\{ I \} = \frac{A}{s+2} + \frac{Bs+D}{s^2 + 3600}$$

$$\frac{7200 e^{-6s}}{(s^2 + 3600)(s+2)} = \frac{A}{s+2} + \frac{(Bs+D)}{s^2 + 3600}$$

$$7200 e^{-6s} = A(s^2 + 3600) + (Bs+D)(s+2)$$

$$7200 e^{-6s} = As^2 + 3600A + Bs^2 + (D+2B)s + 2D$$

$$= (A+B)s^2 + (D+2B)s + (3600A+2D)$$

$$\begin{cases} A+B=0 \\ D+2B=0 \\ 3600A+2D=7200 e^{-6s} \\ -2D-4B=0 \end{cases}$$

$$\frac{3600A - 4B = 7200 e^{-6s}}{4A + 4B = 0}$$

$$3604A = 7200 e^{-6s}$$

$$A = \frac{7200}{3604} e^{-6s} \quad B = -\frac{7200}{3604} e^{-6s}$$

$$D = -\frac{14400}{3604} e^{-6s}$$

$$\{ I \} = \frac{7200 e^{-6s}}{3604} \cdot \frac{1}{s+2} - \frac{7200 e^{-6s}}{3604} \left(\frac{s+2}{s^2 + 3600} \right)$$

$$\{ I \} = \frac{7200}{3604} \left[\frac{e^{-6s}}{s+2} \right] - \frac{7200}{3604} \left[\frac{e^{-6s}}{s^2 + 3600} \right] - \frac{7200 \cdot 2}{3604 \cdot 60} \left[\frac{60 e^{-6s}}{s^2 + 3600} \right]$$

$$I(t) = \frac{7200}{3604} u(t-6) e^{-2(t-6)} - \frac{7200}{3604} u(t-6) \cos(60(t-6)) - \frac{14400}{3604 \cdot 60} u(t-6) \sin(60(t-6))$$

$$\text{LapTransfPartSol} := \text{laplace}(II(t), t, s) = \frac{7200 e^{-6s}}{(s^2 + 3600)(s + 2)}$$

$$\mathcal{L}\{I\} = \frac{7200 \cdot e^{-6s}}{(s^2 + 3600)(s + 2)}$$

$$R = \frac{e^{-2s}(s+3)}{(s+3)^2 + 4}$$

$$r(t) = \mathcal{L}^{-1} \left\{ \frac{e^{-2s}(s+3)}{(s+3)^2 + 4} \right\}$$