Relation	R	C	L
Voltage	$V = IR$	$V = \frac{1}{C}\int_{t_0}^{t} i(t)\,dt + V_0$	$V = L\frac{di}{dt}$
Current	$I = \frac{V}{R}$	$I = C\frac{dv}{dt}$	$I = \frac{1}{L}\int_{t_0}^{t_1} V(t)\,dt + I_0$
P/W	$P_R = \frac{V^2}{R}, I^2R, IV$	$W_C = \frac{1}{2}CV^2$	$W_L = \frac{1}{2}LI^2$

$$u(t) = \begin{cases} 0 & t < 0 \\ 1 & t \geq 0 \end{cases}$$

$$u(t-t_0) = \begin{cases} 0 & t < t_0 \\ 1 & t \geq t_0 \end{cases}$$

Chapter 7:

$\boxed{\tau = RC}$

RC-circuit

- Discharge $V_{(t)} = V_0 e^{-t/\tau}$
- V is the Voltage of Capacitor
- Charge $V_{(t)} = V_\infty + [V_0 - V_\infty] e^{-t/\tau}$

$\boxed{\tau = \frac{L}{R}}$

RL-Circuit

- Discharge $I_{(t)} = I_0 e^{-t/\tau}$
- I is the Current of inductor
- Charge $I_{(t)} = I_\infty + [I_0 - I_\infty] e^{-t/\tau}$

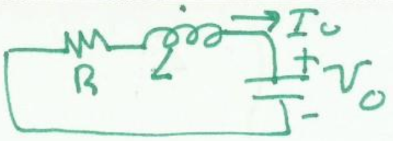
if the C or L Charge or Discharge at $t \neq 0$

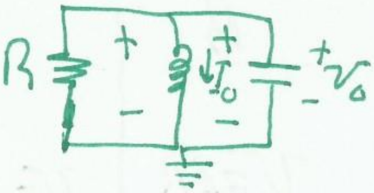
Then $e^{-t/\tau} \Longrightarrow e^{-(t-c)/\tau}$

$\boxed{\text{c is The Time when it Charge or Discharge}}$

Tip: The Rules at Top of the Page are for current going from + to −

Ch8: —





Series RLC circuit

$\alpha = \frac{R}{2L}$, $\omega_0 = \frac{1}{\sqrt{LC}}$, $S_1 = -\alpha + \sqrt{\alpha^2 - \omega_0^2}$

$S_2 = -\alpha - \sqrt{\alpha^2 - \omega_0^2}$ $\left\{ \begin{array}{ll} \alpha > \omega_0 & \text{over} \\ \alpha = \omega_0 & \text{critical} \\ \alpha < \omega_0 & \text{under} \end{array} \right\}$ DamPing

$\omega_d = \sqrt{\omega_0^2 - \alpha^2}$ $\boxed{u(-t) = \begin{cases} 0 & t > 0 \\ 1 & t \leq 0 \end{cases}}$

Discharging:

$$\begin{cases} \alpha > \omega_0 & i(t) = A_1 e^{S_1 t} + A_2 e^{S_2 t} \\ \alpha = \omega_0 & i(t) = (A_2 + A_1 t) e^{-\alpha t} \\ \alpha < \omega_0 & i(t) = e^{-\alpha t}(B_1 \cos(\omega_d t) + B_2 \sin(\omega_d t)) \end{cases}$$

i(t) is The current of inductor

$$\frac{di(0)}{dt} = -\frac{1}{L}(R I_0 + V_0)$$

Always Check Polarity of Capacitor here

Charging:

$$\begin{cases} \alpha > \omega_0 & V(t) = V_\infty + A_1 e^{S_1 t} + A_2 e^{S_2 t} \\ \alpha = \omega_0 & V(t) = V_\infty + (A_1 + A_2 t) e^{-\alpha t} \\ \alpha < \omega_0 & V(t) = V_\infty + (A_1 \cos \omega_d t + A_2 \sin \omega_d t) e^{-\alpha t} \end{cases}$$

V(t) is the Voltage of Capacitor

$$\boxed{I(0) = c\left(\frac{dv(0)}{dt}\right)}$$

Parallel RLC circuit:

$\alpha = \frac{1}{2RC}$, $\omega_0 = \frac{1}{\sqrt{LC}}$, $\frac{dv(0)}{dt} = -\frac{(V_0 + R I_0)}{RC}$

Discharging

$\alpha > \omega_0$ $V(t) = A_1 e^{S_1 t} + A_2 e^{S_2 t}$

$\alpha = \omega_0$ $V(t) = (A_1 + A_2 t) e^{-\alpha t}$

$\alpha < \omega_0$ $V(t) = e^{-\alpha t}(A_1 \cos(\omega_d t) + A_2 \sin \omega_d t)$

Voltage of Capacitor

Charging: $I(t) = I_\infty + A_1 e^{S_1 t} + A_2 e^{S_2 t}$ $(\alpha > \omega_0)$

$I(t) = I_\infty + (A_1 + A_2 t) e^{-\alpha t}$ $(\alpha = \omega_0)$

$I(t) = I_\infty + (A_1 \cos \omega_d t + A_2 \sin \omega_d t) e^{-\alpha t}$ $(\alpha < \omega_0)$

Current of Inductor

$$\boxed{V(0) = L\left(\frac{di(0)}{dt}\right)}$$