# Ben Yusufov RLC question 4

Find the current in the RLC circuit, assuming that $E(t) = 0$ for $t > 0$.

4. $R = 6\ \Omega$ $L = .1$ henrys $C = .004$ farads $Q_0 = 3$ columbs $I_0 = -10$ amperes.

to find the current in the RLC circuit, we need to solve second order equation that describes the circuit. For series RLC circuit with a resistor ($R$), inductor ($L$) and capictor ($C$)

second order diff equation homogenous $\Rightarrow \frac{1}{10}Q'' + 6Q' + 250Q = 0$ (we don't want a fraction so we multiply) $\rightarrow Q'' + 60Q' + 2500Q = 0$

$\rightarrow r^2 + 60r + 2500 = 0$

quadratic formula $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \rightarrow \frac{-60 \pm \sqrt{60^2 - 4(1)(2500)}}{2(1)}$

$\rightarrow \frac{-60 \pm \sqrt{3600 - 10000}}{2}$

$\rightarrow \frac{-60 \pm \sqrt{-6400}}{2}$

$\rightarrow \frac{-60 \pm 80i}{2}$

$\rightarrow -30 \pm 40i$

$r_1 = -30 + 40i$
$r_2 = -30 - 40i$

$r_1 = -30 + 40i$
$r_2 = -30 - 40i$ > second order homogenous Constant coefficient - Complex

$Q = e^{-30}(3\cos 40t + B\sin 40t)$ ← unknown function

Since $Q_0 = 3$ $I = Q' = e^{-30t}((40B - 90)\cos 40t - (30B + 120)\sin 40t)$

$I_0 = -10 \Rightarrow 40B - 90 = -10$
$+90 \quad +90$
$40B = 80$
$B = 2$

now, $-30B - 120 = -180$
$-30(2) - 120 = -180$
$-60 - 120 = -180$ ✓

$$I = -10e^{-30t}(\cos 40t + 18\sin 40t)$$