Question:Question: At t = 0 a current of 2 amperes flows in an RLC circuit with resistance R = 40 ohms, inductance L...

At $t = 0$ a current of 2 amperes flows in an *RLC* circuit with resistance $R = 40$ ohms, inductance $L =$ 0.2 henrys, and capacitance $C = 10^{-4}$ farads. Find the current flowing in the circuit at $t > 0$ if the initial charge on the capacitor is 1 coulomb. Assume that $E(t) = 0$ for $t > 0$.

- Must start by writing a differential equation and solving it.

$R = 40$ ohm

$L = 0.2$ henrys

$C = 10^{-4}$ farads

$E(t) = 0$

Let $q(t)$ be charge flowing at time t

$q(0) = 1$ coulomb

$q'(0) = 0$

$$Lq'' + Rq' + \frac{1}{C}q = E(t)$$

$$\Rightarrow 0.2q'' + 40q' + 10000q = 0$$

0.2 q'' + 40 q' + 10000 q = 0

auxilary equation is

0.2 r^2 + 40 r + 10000 = 0

root r is -100 + 200 i, -100 - 200 i

solution is q(t) = e^(-100t) (c1 cos(200 t) + c2 sin(200 t))

q'(t) = e^(-100t) (-200 c1 sin(200 t) + 200 c2 cos(200 t)
-100 c1 cos(200 t)-100 c2 sin(200 t)

Put q(0) = 1, q'(0) = 0

1 = c1

0 = 200 c2 -100 c1

on solving

c1 = 1, c2 = 0.5

hence q(t) = e^(-100t) (1 cos(200 t) + 0.5 sin(200 t))