Connor McGarty, cmcgarty - P2.11, Chapra Text

File: cmcgarty_P2_11.m

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Problem P2.11: A simple electric circuit consisting of a resistor, a capacitor, and an inductor is depicted as shown in Fig. P2.11. The charge on the capacitor $q(t)$ as a function of time can be computed as

$$q(t) = q_0 e^{\frac{-Rt}{2L}} \cos[\sqrt{\frac{1}{LC} - (\frac{R}{2L})^2 t}]$$

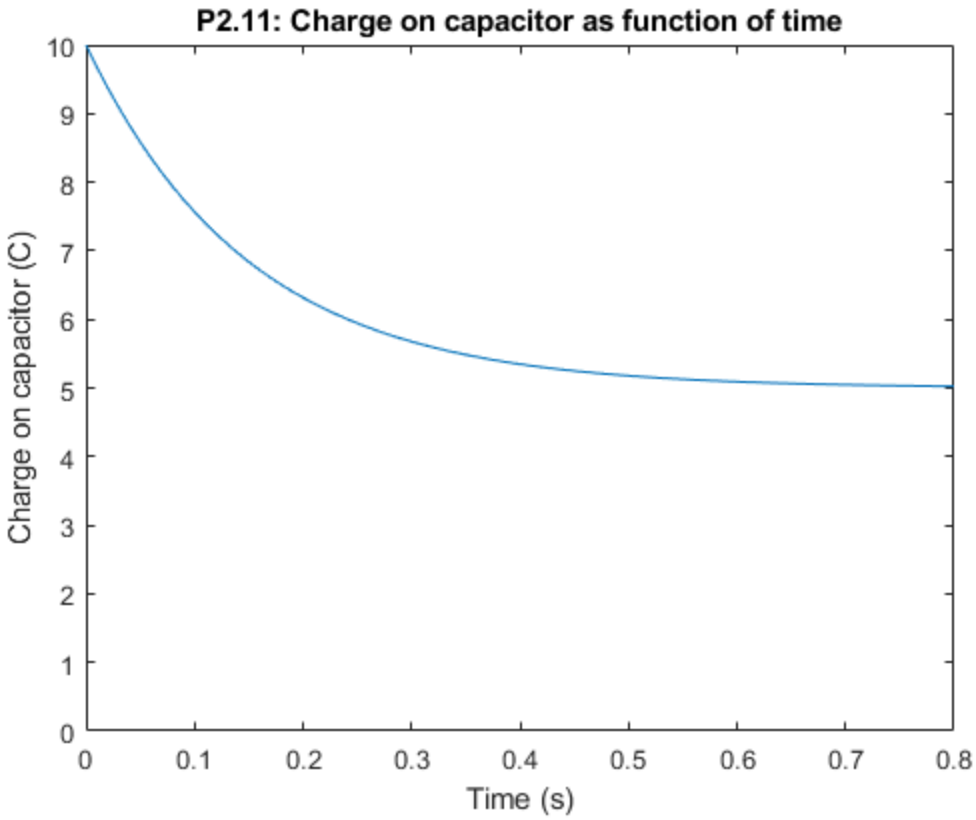
where $t =$ time, $q_0 = 10$, the initial charge, $R = 60$, the resistance, %L=9$, the inductance, and $C = 0.00005$, the capacitance. Use MATLAB to generate a plot of this function from $t = 0$ to 0.8 given the above.

Solution

```
clear;clc;
initial_charge = 10; % coulombs
resistance = 60; % ohms
inductance = 9; % H
capacitance = 0.00005; % F
t_init = 0; % s
t_final = 0.8; % s
t_delta = 0.01; % s
t_vector = [t_init : t_delta : t_final];

q_time = initial_charge .* exp((-resistance .* t_vector) ./ (2 *
 inductance)) ...
    .* cos(sqrt((1 / inductance * capacitance) - ...
    ((resistance / (2 * inductance)) .^ 2)) .* t_vector);

plot(t_vector, q_time);
xlabel('Time (s)');
ylabel('Charge on capacitor (C)');
ylim([0, 10]);
title('P2.11: Charge on capacitor as function of time');
```



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