

THE RCL CIRCUIT PART - 1

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PROBLEM 4

Applications of Second Order Equations-RLC Circuit: Problem 4

A series circuit is constructed with resistance 120Ω , capacitance $\frac{1}{5} \times 10^{-4}$ F, and inductance $\frac{1}{5}$ H.

What is the differential equation for the charge in this circuit? (Use Q as the dependent variable.)

 $\left[\frac{1}{5}Q'' + 120Q' + 50000Q = 0\right]$

This system is underdamped

What amount of resistance would cause the system to be critically damped?

200

□ What is the differential equation for the charge in this circuit? (Use Q as the dependent variable.)

The Solution is 1/5 Q"+120Q'+50000Q = 0

□ What is the system? Underdamped, Critically damped or Overdamped

Characteristics Equation :- $R^2 - 4(L)(\frac{1}{C})$ $= (120)^2 - 4(\frac{1}{5}) \cdot 50000$ - 14400-40000 = - 2560010 So, This system is underdamped.

The solution is Underdamped because we know $R^2 - 4(L) (1/C) < 0$

□ What amount of resistance would cause the system to be critically damped?

For the system to be critically damped $R^{2} = \frac{4L}{C}$ $R^{2} = \frac{4(=)}{+}$ $\frac{+}{+} \times 10^{-4}$ $R^{2} = 40000$ $P = \sqrt{40000}$ P = 200

The Solution is 200.