Questions:

How do we derive the differential equation for voltage and/or current for a component in a series RLC circuit?

How do we derive the differential equation for voltage and/or current for a component in a parallel RLC circuit?

How do we derive the differential equation for voltage and/or current for a component in an arbitrary second order circuit?

What is the solution form for a second order differential equation?

What is resonant frequency, ω_o?

What is the attenuation constant, α?

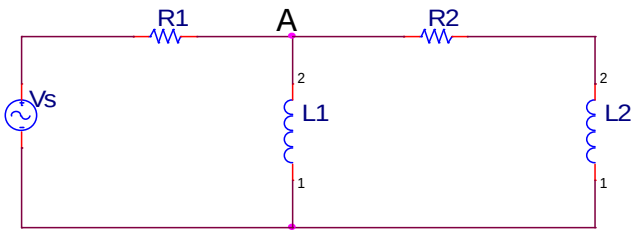
What is an overdamped circuit?

What is a critically damped circuit?

What is an underdamped circuit?

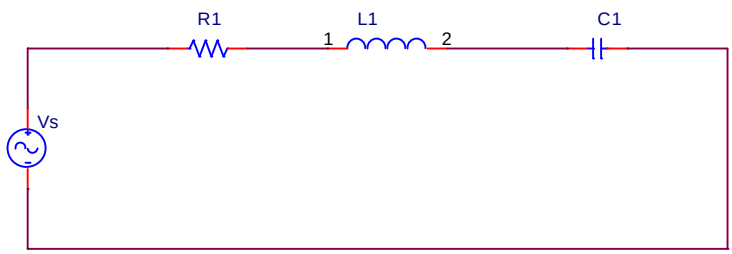
What is the oscillation frequency, β, in an underdamped circuit?

1)



a). In the above circuit, find a differential equation for the current through L2, IL2(t). The source is an arbitrary source. (Hint: Consider applying KCL at A and determine an expression for VA in terms of IL2.)

2) RLC series circuits

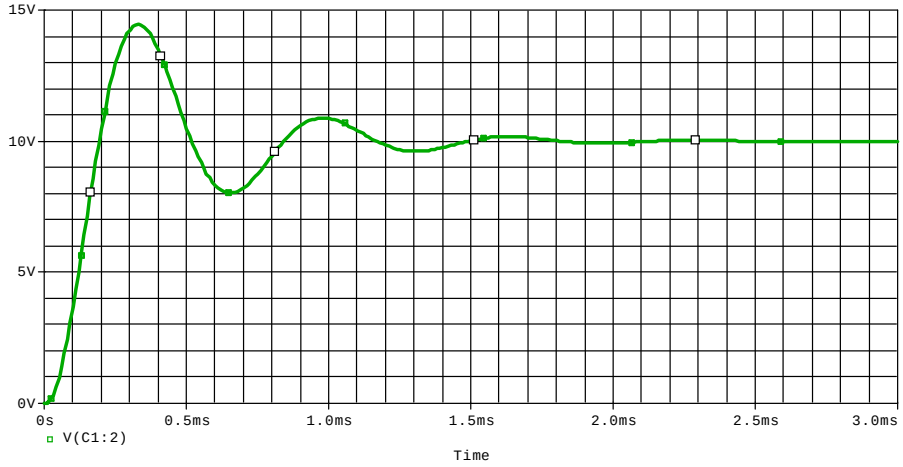


In the above circuit, Vs is a step function source and that turns on at t = 0. Determine the form of the solution for the following conditions (you do not need to solve for the coefficients A1, A2, and A3). Indicate the damping for each case and include calculations of the attenuation constant and resonant frequency in your solution.

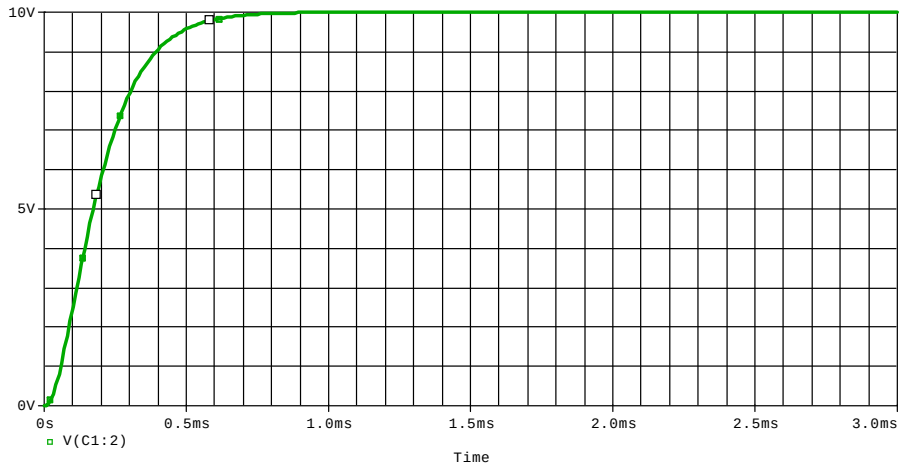
a). $R_1 := 10\Omega$ $L_1 := 1\cdot10^{-2}H$ $C_1 := 1\cdot10^{-6}F$

b). $R_{1b} := 200\Omega$ $L_{1b} := 1\cdot10^{-2}H$ $C_{1b} := 1\cdot10^{-6}F$

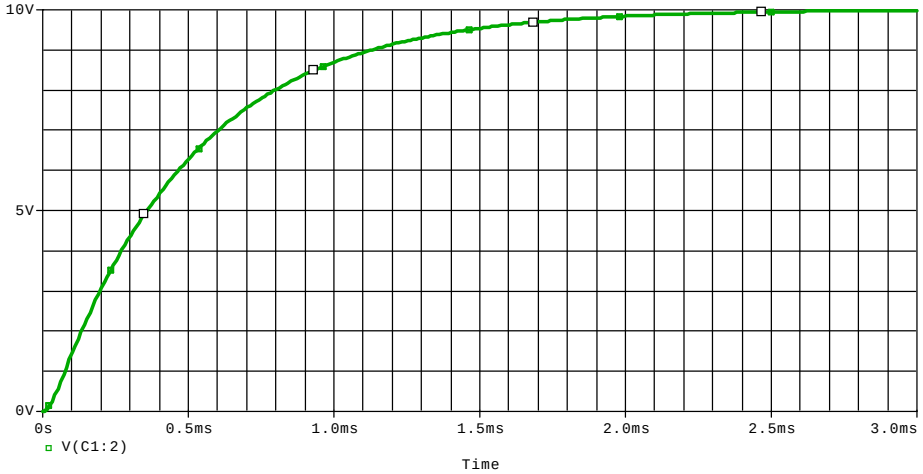
c) $R_{1c} := 1000\Omega$ $L_{1c} := 1\cdot10^{-2}H$ $C_{1c} := 1\cdot10^{-6}F$



Underdamped



Critically damped



Overdamped