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1 %{
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3 ECE 202
4 Exercise M7
5 11/15/2023
6 the purpose of this script is to compute and plot
7 i(t) v(t) p(t) and wf in a RL circuit
8 %}
9 %-----Inititalize-----
10 clear %clear var to set up script
11
12 %-----Given-----
13 v0 = 5; %initial voltage in Volts
14 L = 10; %inductance of inductor in MilliHenries
15 R = 2; %resistance of resistor in Ohms
16 tau = L/R; %time constant
17 n = 400; %number of steps to make in time array
18 t0 = 0; %initial time
19 tf = 10*tau;
20 t = linspace(t0,tf, n+1); %array of time, in milliseconds
21 et = exp(-t./tau); %e^{t/tau}, used more than once so declared to save typing
22 VovrR = v0/R; %calculate this for the formula printout & subsequently the formula too
23 itf = "\ (i(t) = "+num2str(VovrR)+" \cdot e^{\frac{t}{"+num2str(tau)+"}} \)";
24 vtf = "\ (v(t) = "+num2str(v0)+"\cdot e^{\frac{t}{"+num2str(tau)+"}} \)";
25 ptf = "\ (v(t) \cdot i(t))";
26
27 %-----Calculations-----
28 it = VovrR .* (1-et); %the current Amps as a function of time milliseconds
29 vt = v0.*et; %the current voltage as a function of time in milliseconds
30 pt = it.*vt; %the current power consumption of the circuit as a function of
31 % time in milliseconds
32 ifin = VovrR; %calculate final energy stored
33 w = .5*L * ifin^2; %total energy stored in joules in the inductor as a function
34 %of time in milliseconds
35
36 %-----Checks-----
37 check_ab = trapz(pt) - w
38 perc_err = 100*(sum(pt)-w)/w
39 %-----Plotting-----
40 tiledlayout(3,1)
41 sgtitle("RL circuit in series: Current, voltage, and power absorbed", ...
42 "for a charvhing inductor (V_0="+num2str(v0)+"V, R="+num2str(R)+"\Omega, " + ...
43 " L="+num2str(L)+"mH)", 'fontsize',25, 'fontname', 'Times New Roman');
44 itp = nexttile;
45 plot(itp,t, it, 'LineWidth',2, 'Color', 'red');
46 ylim(itp,[0,3])
47 ylabel('Current in Amps')
48 text(itp, 30, 1, itf, 'Interpreter','latex','FontSize',15)
49
50 vtp = nexttile;
51 plot(vtp, t, vt, 'LineWidth',2, 'Color', 'blue');

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52 ylim(vtp,[0,6])
53 text(vtp, 30, 2, vtf, 'Interpreter','latex','FontSize',15)
54 ylabel('Voltage in Volts')
55
56 ptp = nexttile;
57 plot(ptp, t, pt, 'LineWidth',2, 'Color','green');
58 text(ptp, 30, 1, ptf, 'Interpreter','latex','FontSize',15)
59 xlabel(ptp, 'Time (t) in ms')
60 ylabel('Power Consumption in Joules')
61
62
63
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