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% Matlab Code for Series RLC Circuit modeling..
% Praviraj PG (pravirajpg@gmail.com) - Rev 0, 19-Sep-2019
% Solve using ODE45 function with the State-Space Model

function ppgrlcckt

    T = 0.1;           % Simulation Time..
    x0 =  [0; 0];      % Initial Conditions

    % Call MATLAB/Octave ODE45 for Solving..
    % A State-Space model of Series RLC Circuit is implemented inside
    % the function "RLCcktfcn" below
    tspan = [0, T];
    [t, x] = ode45(@(t,x) RLCcktfcn(t,x), tspan, x0);

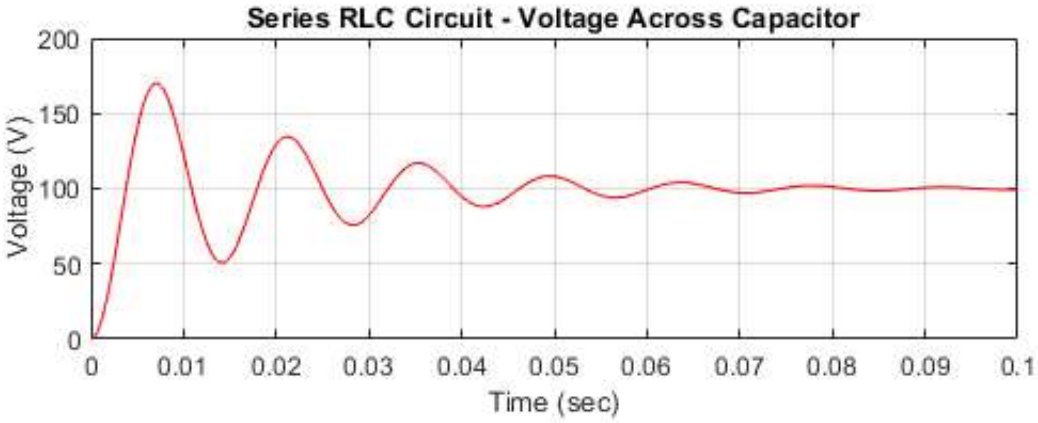
    % Plot Current thru Inductor & Voltage across Capacitor
    Ii = x(:,1);    Vc = x(:,2);

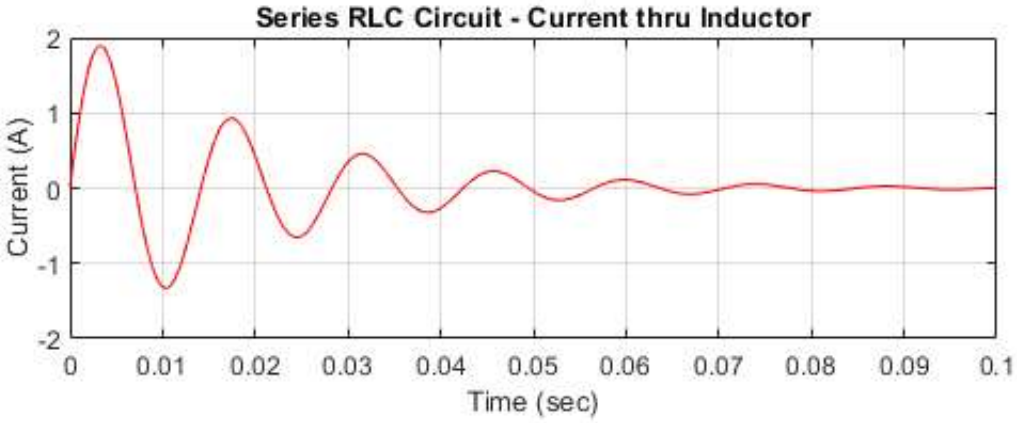
    subplot(2,1,1); plot(t, Vc, 'r', 'linewidth',0.75); grid on;
    title('Series RLC Circuit - Voltage Across Capacitor');
    xlabel('Time (sec)'); ylabel('Voltage (V)');

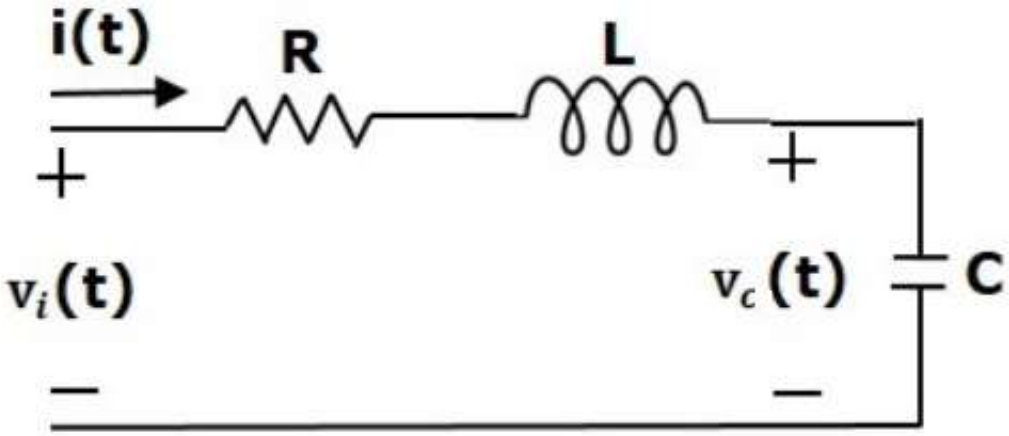
    subplot(2,1,2); plot(t, Ii, 'r', 'linewidth',0.75); grid on;
    title('Series RLC Circuit - Current thru Inductor');
    xlabel('Time (sec)'); ylabel('Current (A)');
end
%--------------------------------------------------------------------

%--------------------------------------------------------------------
% Model Series RLC Circuit function..
function y = RLCcktfcn(t,x)
    R = 10;               % Resistance (Series RL Branch), Ohms..
    L = 100e-3;           % Inductance (Series RL Branch), H..
    C = 50e-6;            % Capacitor (Series RLC Branch), F
    Vi = 100;             % Input Voltage

    % RLC Circuit Dynamic - State-Space Model..
    % y(1) = d (Ii);    y(2) = d (Vc);
    %        /dt               /dt
    y = [-R/L, -1/L; 1/C, 0]*x + [1/L; 0]*Vi;
end
%--------------------------------------------------------------------
```







$$\dot{X} = \begin{bmatrix} \frac{\mathrm{d}i(t)}{\mathrm{d}t} \\ \frac{\mathrm{d}v_c(t)}{\mathrm{d}t} \end{bmatrix} = \begin{bmatrix} -\frac{R}{L} & -\frac{1}{L} \\ \frac{1}{C} & 0 \end{bmatrix} \begin{bmatrix} i(t) \\ v_c(t) \end{bmatrix} + \begin{bmatrix} \frac{1}{L} \\ 0 \end{bmatrix} \begin{bmatrix} v_i(t) \end{bmatrix}$$

Published with MATLAB® R2019b