
```

%set constants
R = 1000; %resistance is 1000 ohms
C = 10^-6; %capacitance is 1 micro farad
V_C = 0; %initial voltage across capacitor is 0 volts
V_in = 1; %voltage in is 1 volt
V_R = 0; %initial voltage across resistor is 0

%choose a value for h
h_good = 10^-6;
h_bad = 10^-3;

%create empty matrices to store values in
V_time_data_good = [5000, 3];
V_time_data_bad = [5000, 3];

%iterate linear dynamical system for 5000 time steps
for k=1:5000

    %equation for voltage across capacitor after 1 additional time
    step
    V_C_f = (1-h_good/(R*C))*V_C+h_good/(R*C)*V_in;
    %change the prior voltage to the new voltage after 1 time step
    V_C = V_C_f;

    %record voltage in, voltage across capacitor, and time in a matrix
    V_time_data_good(k, 1) = V_in;
    V_time_data_good(k, 2) = V_C;
    V_time_data_good(k, 3) = k*h_good;
end

% Reset voltage across capacitor.
V_C = 0;

%iterate linear dynamical system for 5000 time steps with different h
for k=1:5000
    V_C_f = (1-h_bad/(R*C))*V_C+h_bad/(R*C)*V_in;
    V_C = V_C_f;
    V_time_data_bad(k, 1) = V_in;
    V_time_data_bad(k, 2) = V_C;
    V_time_data_bad(k, 3) = k*h_bad;
end

%plot voltages versus time
figure;
hold on;
plot(V_time_data_good(:, 3),V_time_data_good(:, 1), "LineWidth", 2);
plot(V_time_data_good(:, 3), V_time_data_good(:, 2), "LineWidth", 2);
legend("V_i_n", "V_C", "FontSize", 14);
title("RC Voltage v.s. Time", "FontSize", 14);
xlabel("time (s)", "FontSize", 14);
ylabel("voltage (V)", "FontSize", 14);

```

```

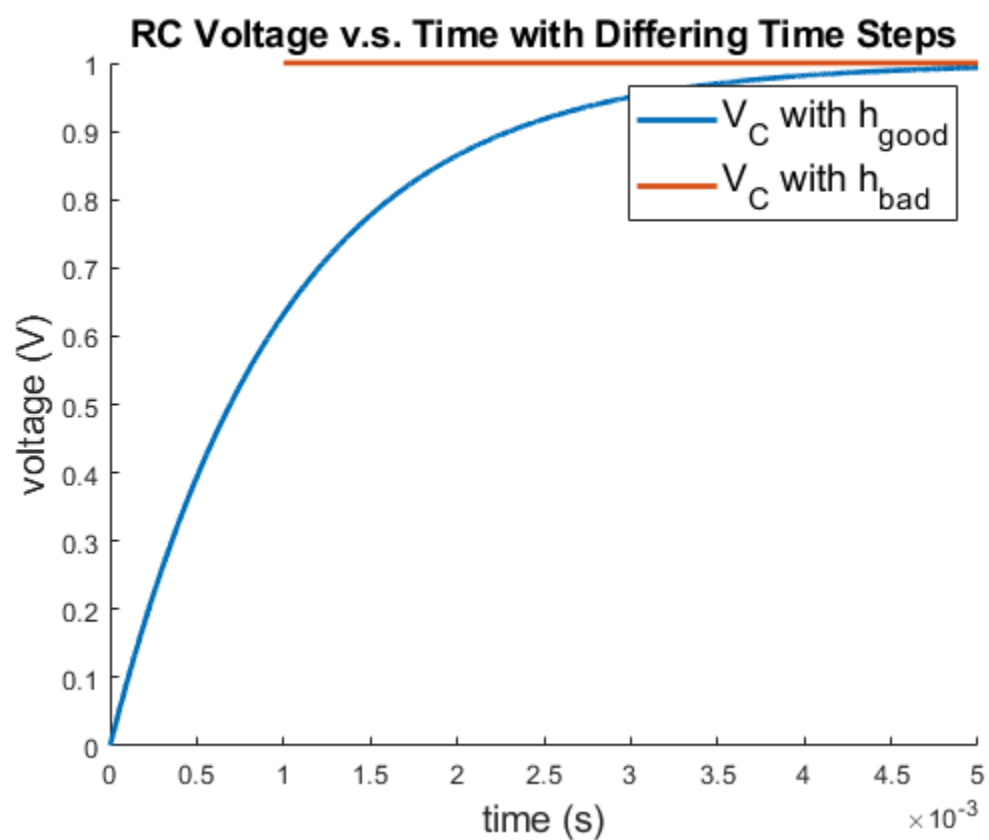
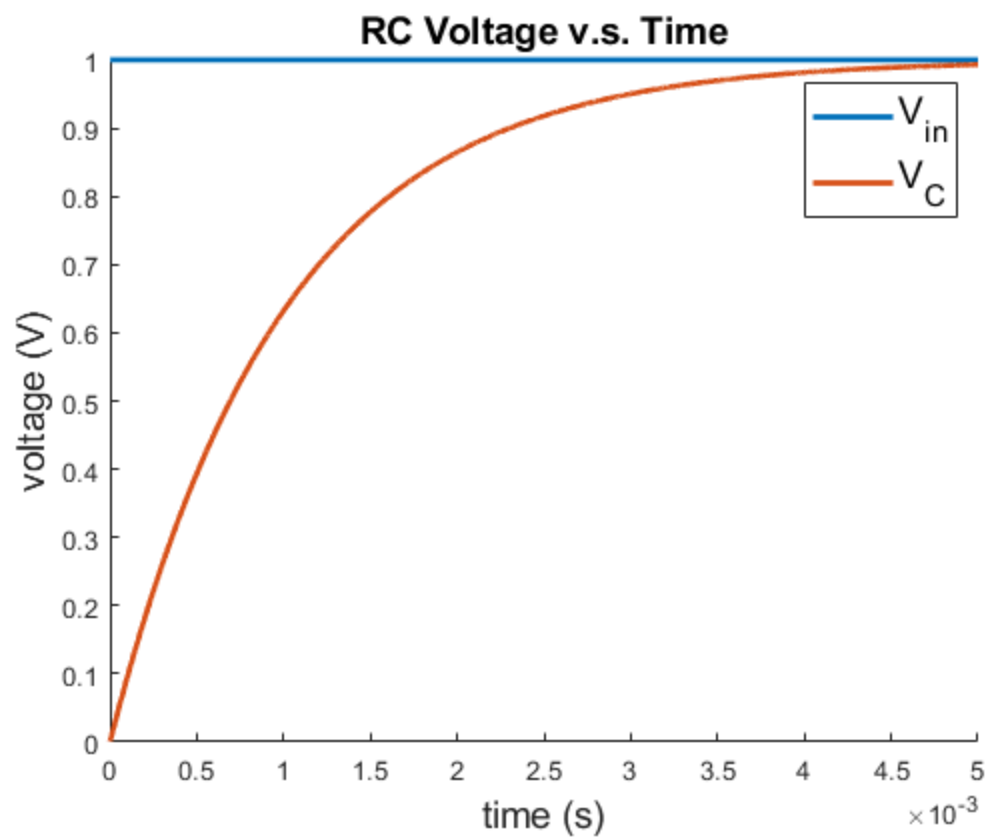
hold off;

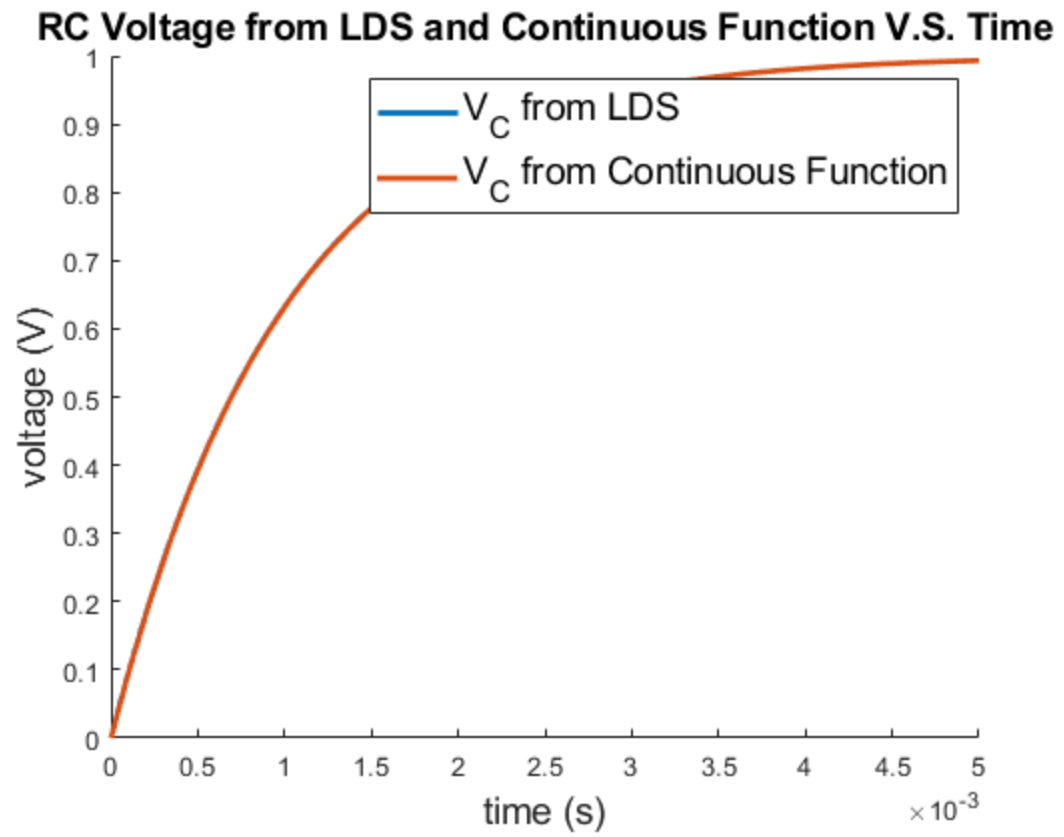
%plot voltages across capacitor versus time with differing h
figure;
hold on;
plot(V_time_data_good(:, 3), V_time_data_good(:, 2), "LineWidth", 2);
plot(V_time_data_bad(:, 3), V_time_data_bad(:, 2), "LineWidth", 2);
xlim([0, 5*10^-3]);
legend("V_C with h_g_o_o_d", "V_C with h_b_a_d", "FontSize", 14);
title("RC Voltage v.s. Time with Differing Time Steps", "FontSize",
    14);
xlabel("time (s)", "FontSize", 14);
ylabel("voltage (V)", "FontSize", 14);
hold off;

%plot voltages against time from linear dynamical system and
    continuous
%function
figure;
hold on;
plot(V_time_data_good(:, 3), V_time_data_good(:, 2), "LineWidth", 2);
fplot(@(t) 1-exp(1)^(-t/(R*C)), "LineWidth", 2);
xlim([0, 5*10^-3]);
legend("V_C from LDS", "V_C from Continuous Function", "FontSize",
    14);
title("RC Voltage from LDS and Continuous Function V.S.
    Time", "FontSize", 14);
xlabel("time (s)", "FontSize", 14);
ylabel("voltage (V)", "FontSize", 14);
hold off;

```

Warning: Function behaves unexpectedly on array inputs. To improve performance, properly vectorize your function to return an output with the same size and shape as the input arguments.





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