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1 % Khushkumar Jajoo
2 % 11/13/2021
3 % ECE 202 Fall 2021
4 % Project 1 phase 4
5 % Plotting the sum of non zero terms of truncated power
6 % series for  $f(t) = 12 \cos 40(t)$  upto six non zero terms
7 % Making the script more efficient
8
9 clear
10 clf
11 format shortG
12
13 tmin = 0; % starting time in ms
14 tmax = 200; % end time in ms
15 N = 401; % number of points in linspace
16 tms = linspace(tmin, tmax, N); % time array in ms
17 t = tms/1000; % converting time array from ms to s
18
19 %  $f = 12 \cos(40 \cdot t)$  target function to plot
20
21 A = 12; % amplitude in the function and graph
22 w = 40; % angular frequency in function and graph, in rad/s
23 terms = 6; % number of non zero terms to be printed
24
25 n = 0:2:(terms-1)*2; % first non zero six terms indices in series
26 % (only even terms)
27
28 a = A*(-1).^(n/2).*w.^n ./ factorial(n); % the general expression
29 % from handwork
30
31 output_table = table(n.', a.', 'VariableName',...
32     {'Index n', 'Coefficients'})
33
34 %----- Creating plotting functions-----
35 f=zeros(1,N);
36 p = zeros(terms,1);
37 plot([tmin,tmax], [0,0], 'k', 'LineWidth', 1);
38 hold on
39 for i = 1:terms
40     f = f + a(i)*t.^n(i);
41     if i ~= terms
42         p(i) = plot(tms, f, "LineWidth", 2);
43     else
44         p(terms) = plot(tms, f, "LineWidth", 4);
45     end
46 end
47 hold off
48
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49 %----- Check using previous script-----
50 f1 = a(1) * t.^n(1); % first non zero term
51 f2 = f1 + a(2)*t.^n(2); % sum of first and second non zero term
52 f3 = f2 + a(3)*t.^n(3); % sum of first three non zero terms
53 f4 = f3 + a(4)*t.^n(4); % sum of first four non zero terms
54 f5 = f4 + a(5)*t.^n(5); % sum of first five non zero terms
55 f6 = f5 + a(6)*t.^n(6); % sum of first six non zero terms
56
57 check = sum(abs(f-f6)); % should be zero
58
59 %----- plotting the graph-----
60 ax = gca;
61 ax.FontSize = 16;
62 ylim([-1.25*A,1.25*A])
63 xlabel("time t (ms)", "FontSize", 18)
64 ylabel("f(t)", "FontSize", 18)
65 str1 = sprintf("Power series expansion of f(t) = %ucos(%ut)",A,w);
66 str2 = sprintf("using truncated sums up to first %u non-zero terms"...
67               ,terms);
68 title(["ECE 202, Project-1, Phase 4", str1, str2], "FontSize", 24);
69 legend (p, "up to n = "+n,"FontSize",18, "Location",...
70         "NorthEastoutside");
71 grid on
72 set (gca,"GridAlpha",0.4);
```