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1 % Aidan Chin
2 % 12/10/23
3 % ECE 202: Project 1 phase 3
4
5 %---initialize---
6
7 format shortG
8 clear
9 clc
10
11 %---setup---
12
13 A = 7; %amplitude of sinusoid
14 w = 10; %angular frequency of sinusoid
15 num_terms = 6; %number of non-zero terms
16 tmin = 0; %min time in ms
17 tmax = 500; %max time in ms
18 N = 1000; %number of points for plotting
19
20 t_ms = linspace(tmin,tmax,N); % make time array t in seconds from 0s to 0.5s
21 t = t_ms/1000; % convert time t to ms from 0ms to 500ms
22
23 n = [0:2:10]; % n values of non-zero coefficients
24 a_n = (-1).^(n/2).*(20.^n)*7./factorial(n); % a_n values of non-zero coefficients
25
26 %make a table
27 T = table(n',a_n','VariableNames',{ 'n values', ...
28     'a_n values (Non-zero coefficients)'});
29
30 % ---- calculations ----
31
32 f1 = a_n(1)*t.^n(1); % First term
33 f2 = f1 + a_n(2)*t.^n(2); % 1-2 term
34 f3 = f2 + a_n(3)*t.^n(3); % 1-3 terms
35 f4 = f3 + a_n(4)*t.^n(4); % 1-4 terms
36 f5 = f4 + a_n(5)*t.^n(5); % 1-5 terms
37 f6 = f5 + a_n(6)*t.^n(6); % 1-6 terms
38
39 % ---- plotting ----
40
41
42 hold on %keeps from making new plots
43 p1 = plot(t_ms,f1,t_ms,f2,t_ms,f3,t_ms,f4,t_ms,f5,'LineWidth', 2);
44 %plot first 5 coefficients
45 p2 = plot(t_ms,f6,'LineWidth', 4); %plot 6th coefficient as thicker
46 plot([0,500], [0,0], 'k', 'LineWidth', 1) %plot horizontal line
47 grid on %turn on gridlines
48 ax = gca; %initialize gca
49 ax.GridAlpha = 0.4; %change grid
50 ax.FontSize = 16; %change chart font size
51
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52 title(sprintf("ECE 202 Project 1 Phase 3: Power series expansion \n of " + ...
53     "f(t)=%gcos(%gt) up to first %g non-zero " + ...
54     "terms",A,w,num_terms),Interpreter='latex',FontSize=21)
55 %make title
56 xlabel("Time (t) in milliseconds", "FontSize",18)
57 %add title for x
58 ylabel(sprintf("First six non-zero terms of " + ...
59     "f(t)=%gcos(%gt)",A,w),Interpreter='latex',FontSize=18)
60 %add title for y
61 ylim([-1*(A+3) A+3])
62 %change bounds
63 terms = 1:6;
64 legend([p1; p2],"terms: "+ terms + ", n = " + n,Location="southoutside", ...
65     FontSize=18,NumColumns=3)
66 %create legend automatically
67 %results are the same as phase 2
68
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