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1 % Kavya Manchanda
2 % 11/1/2022
3 % ECE 202: Project 1 – Power Expansion Series of function of the form
4 % Acos(wt)
5 % Phase 3 : Making the script more robust and general
6
7 clear; clf;
8 format shortG;
9
10 A = 12;           % amplitude
11 w = 40;           % angular frequency in rad/s
12 nz = 6;           % Number of non-zero terms
13
14 tmin = 0;         % in ms
15 tmax = 200;       % in ms
16 N = 400;         % intervals
17
18 tms = linspace(tmin, tmax, N+1); % time array in ms
19 t = tms/1000;     % time array in s
20 n = 0:2:2*nz - 2; % array of nth term
21
22 % The angular frequency in rad/s
23 an = A*(-1).^(n./2).*w.^n./factorial(n);
24
25 coefTable = table(n.',an.','VariableNames',{'n', 'a_n'})
26
27 f1 = an(1)*t.^n(1); % first sum (ie. first term) in the power series
28 f2 = f1 + an(2)*t.^n(2); % sum of first two terms
29 f3 = f2 + an(3)*t.^n(3); % sum of first three terms
30 f4 = f3 + an(4)*t.^n(4); % sum of first four terms
31 f5 = f4 + an(5)*t.^n(5); % sum of first five terms
32 f6 = f5 + an(6)*t.^n(6); % sum of first six terms
33
34 %----- plotting the graph and its attributes -----
35 hold on
36
37 plot([tmin,tmax],[0,0], 'k', 'LineWidth', 1);
38 p1 = plot(tms,f1,tms,f2,tms,f3,tms,f4,tms,f5,'LineWidth',2.5);
39 p2 = plot(tms,f6,'LineWidth',5);
40 legend([p1;p2],"Up to n = " + n,"FontSize",18,"Location","bestoutside")
41
42 ax = gca;
43 ax.GridAlpha = 0.4;
44 ax.FontSize = 16;
45 xlabel('time t (ms)','FontSize',18);
46 ylabel('f(t)','FontSize',18)
47 ylim([-1.25*A,1.25*A])
48 str1 = sprintf("Power series expansion of f(t) = %gcos(%gt)",A,w);
49 str2 = sprintf("using truncated sums up to %g non-zero terms",nz);
50 title(["ECE 202, Project 1 Phase 3:",str1,str2],"FontSize",22)
51
52 grid on
53 hold off
54
55 % The output for Phase 3 is the same as the output for Phase 2.

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>> project1phase3
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coefTable =
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```
6×2 table
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n	a_n
0	12
2	-9600
4	1.28e+06
6	-6.8267e+07
8	1.9505e+09
10	-3.4675e+10

```
>>
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ECE 202, Project 1 Phase 3:
Power series expansion of $f(t) = 12\cos(40t)$
using truncated sums up to 6 non-zero terms

