ECE 202-Project 1 -Phase 1

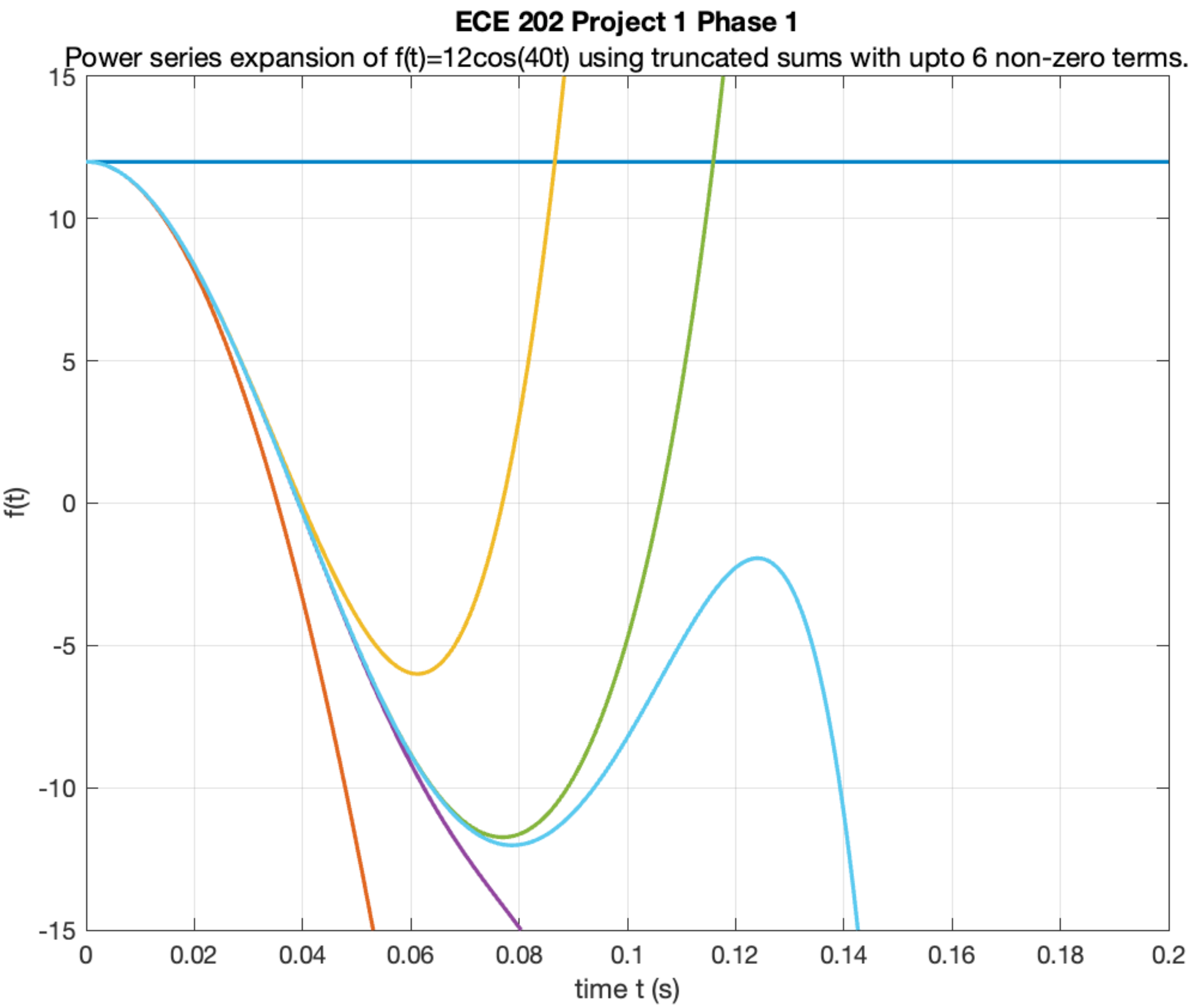
n	$f^n(t)$	$f^n(0)$
0	$12\cos(40t)$	12
1	$-12(40)\sin(40t)$	0
2	$-12(40^2)\cos(40t)$	$-12(40)^2$
3	$12(40^3)\sin(40t)$	0
4	$+12(40^4)\cos(40t)$	$12\cdot(40^4)$
5	$-12(40^5)\sin(40t)$	0
6	$-12(40^6)\cos(40t)$	$-12\cdot(40^6)$

$$a_n = \begin{cases} \dfrac{12(-1)^{n/2}\cdot 40^n}{n!}, \quad \because a_n = \dfrac{f^n(0)}{n!}, & n \text{ is even} \\ \dfrac{0}{n!} = 0, & n \text{ is odd} \end{cases}$$

. So, first 6 non-zero terms will be $n = 0, 2, 4, 6, 8, 10$

```matlab
% Kavya Manchanda
% 11/1/2022
% ECE 202: Project 1 - Power Expansion Series
% Phase 1 :
% Expressing 12cos(40t) as the sum of an infinite power series aka Taylor
% series

clear; clf;
format shortG;

tmin = 0;
tmax = 0.2; % in s


t = linspace(tmin, tmax, 401);  % time in s

n = 0:2:10;  % number of terms

% The coefficients associated with the power series expansion
an = 12.*(-1).^(n./2).*40.^n./factorial(n)

f1 = an(1)*t.^n(1);      % first sum (ie. first term) in the power series
f2 = f1 + an(2)*t.^n(2); % sum of first two terms
f3 = f2 + an(3)*t.^n(3); % sum of first three terms
f4 = f3 + an(4)*t.^n(4); % sum of first four terms
f5 = f4 + an(5)*t.^n(5); % sum of first five terms
f6 = f5 + an(6)*t.^n(6); % sum of first six terms

plot(t,f1,t,f2,t,f3,t,f4,t,f5,t,f6,'LineWidth',1.6)
xlabel('time t (s)');
ylabel('f(t)')
ylim([-15,15])
title("ECE 202 Project 1 Phase 1")
subtitle("Power series expansion of f(t)=12cos(40t) using truncated " + ...
    "sums with upto 6 non-zero terms.")

grid on
```

```
>> project1phase1

an =

          12        -9600     1.28e+06  -6.8267e+07   1.9505e+09  -3.4675e+10

>>
```


ECE 202 Project 1 Phase 1
Power series expansion of f(t)=12cos(40t) using truncated sums with upto 6 non-zero terms.
f(t)
time t (s)
15
10
5
0
-5
-10
-15
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2