Numerical Methods Homework-2

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1 Find the Taylor series for f (x) = x3 −10x2 +6 about x =5.

ANS :

1. Result :

在x=5處展開

f(5) = 3\*125 – 10\*25 + 6 = -119

f(1)(5) = 3\*25 – 20\*5 = -25

f(2)(5) = 6 \*5 – 20 = 10

f(3)(5) = 6

f(x) = -119 + (-25)\*(x-5) + (10/2!)\*(x-5)^2 + (6/3!)\*(x-5)^3

2 Show that from the viewpoint of Taylor expansion.

ANS :

1. Result :

因此

3(a) Find the Taylor series of sin(x) , and then plot the error as a function of the

number of iteration.

ANS :

1. Code\_function :

Sin\_taylor.m

function [result] = sin\_taylor(x,n)

sign = 1;

result = 0;

fac = 1;

x\_m = x;

for i = 1:n

result = result + sign.\*x\_m./fac;

fac = fac\*(2\*i)\*(2\*(i)+1);

sign = sign\*-1;

x\_m = x\_m .\* x .\* x;

end

end

1. Code\_main :

close all

clear all

format long

iter\_n = 30;

posi\_x = 1;

error = [];

for i = 1:iter\_n

result = sin\_taylor(posi\_x,i);

real\_r = sin(1);

error = [error,real\_r - result]

end

plot(1:30,error,'x-')

hold on

set(gca,'xtick',-1:2:30)

set(gca,'ytick',-1:0.1:+1)

ylim([-0.5,0.5])

1. Result :

圖(3-a)

3(b) Also find the Taylor series for the even function cos(x) , and then plot it as

family curves ranging from n=0 to n=4.

ANS :

1. Code\_function :

cos\_taylor.m

function [result] = cos\_taylor(x,n)

sign = 1;

result = 0;

fac = 1;

x\_m = x.^0;

for i = 1:n

result = result + sign.\*x\_m./fac;

fac = fac\*(2\*i)\*(2\*(i)-1);

sign = sign\*-1;

x\_m = x\_m .\* x .\* x;

end

end

1. Code\_main :

close all

clear all

format long

iter\_n =5;

posi\_x = -2\*pi:0.1:2\*pi

M = [];

for i = 1:iter\_n

result = cos\_taylor(posi\_x,i);

plot(posi\_x,result,'-')

M = [M;'iter = '+string(i-1)]

hold on

end

real\_r = cos(posi\_x);

plot(posi\_x,real\_r,'k--')

M = [M;'real cos']

legend(M)

y\_axis = 5;

x\_axis = 7;

set(gca,'xtick',-x\_axis:1:x\_axis)

xlim([-x\_axis,x\_axis])

set(gca,'ytick',-y\_axis:0.5:+y\_axis)

ylim([-y\_axis,y\_axis])

xlabel('x')

ylabel('cos(x)')

1. Result :

圖(3-b)

3(c) Plot the real part and imaginary part of the complex function f (x, y) = .

ANS :

1. Code\_main :

close all

clear all

i = sqrt(-1)

func =@(x,y) exp(x+i.\*y);

x\_range = -pi:0.1:pi;

y\_range = -2\*pi:0.1:2\*pi;

[xx,yy] = meshgrid(x\_range,y\_range);

zz = func(xx,yy);

z\_r = real(zz);

z\_i = imag(zz);

figure(1)

mesh(xx,yy,z\_r)

xlabel('x')

ylabel('y')

zlabel('z\_r')

figure(2)

mesh(xx,yy,z\_i)

xlabel('x')

ylabel('y')

zlabel('z\_i')

figure(3)

mesh(xx,yy,sqrt(z\_r.^2+z\_i.^2))

xlabel('x')

ylabel('y')

zlabel('radius')

figure(4)

mesh(xx,yy,atan(z\_i./z\_r))

xlabel('x')

ylabel('y')

zlabel('agnle')

1. Result :

實部圖(3-c)、虛部圖(3-d)、絕對值長度圖(3-e)、角度圖(3-f)

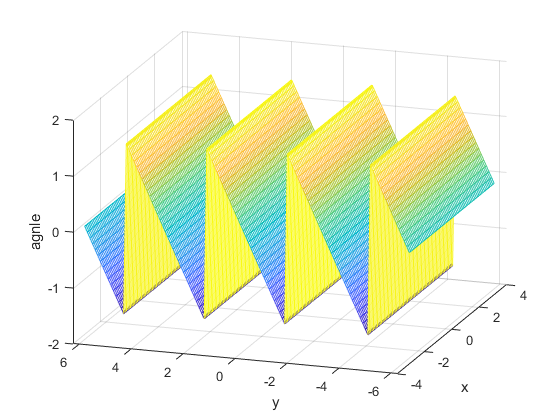
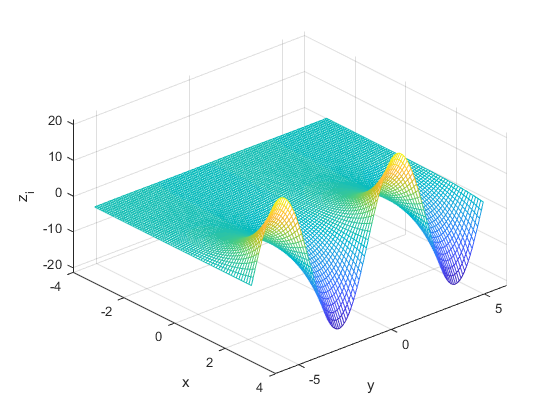
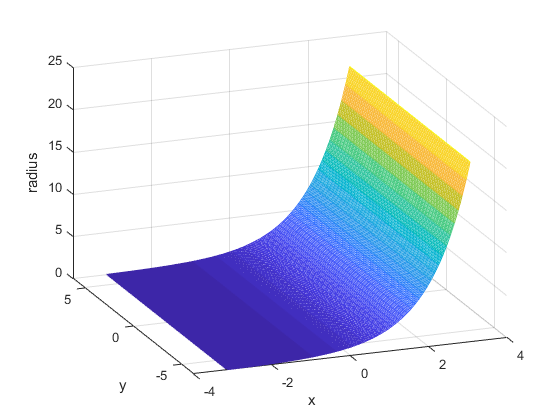
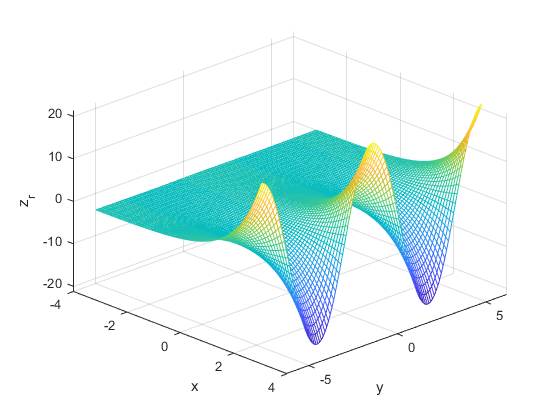
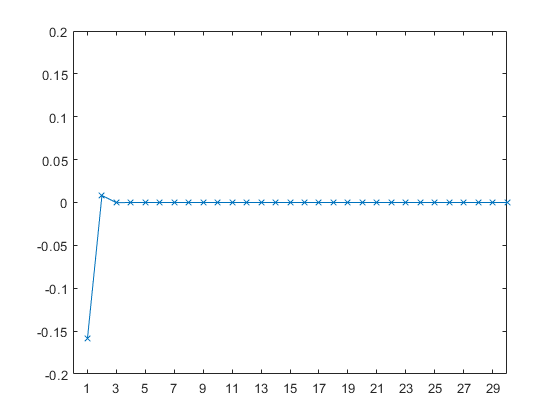
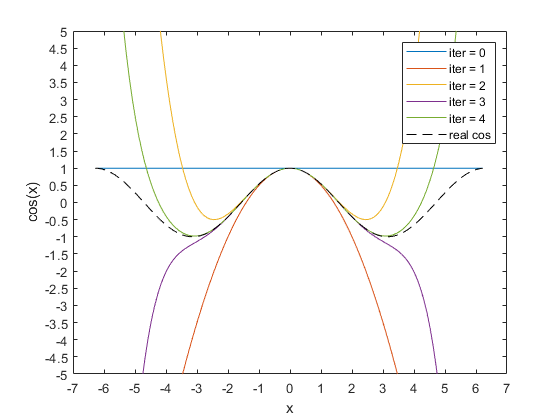


圖3-a Taylor\_sin error of sin(1)

圖3-b Taylor\_cos

圖3-c real part of

圖3-d imaginary part of

圖3-e  absolute value of

圖3-f   angle of