Experiment 8

Vector Fields and Their Integration

I. Aim

Determining the Energy Dissipation in an Asteroid Collision with Earth

Info: << viewSolid & viewSolidOne files are used >>

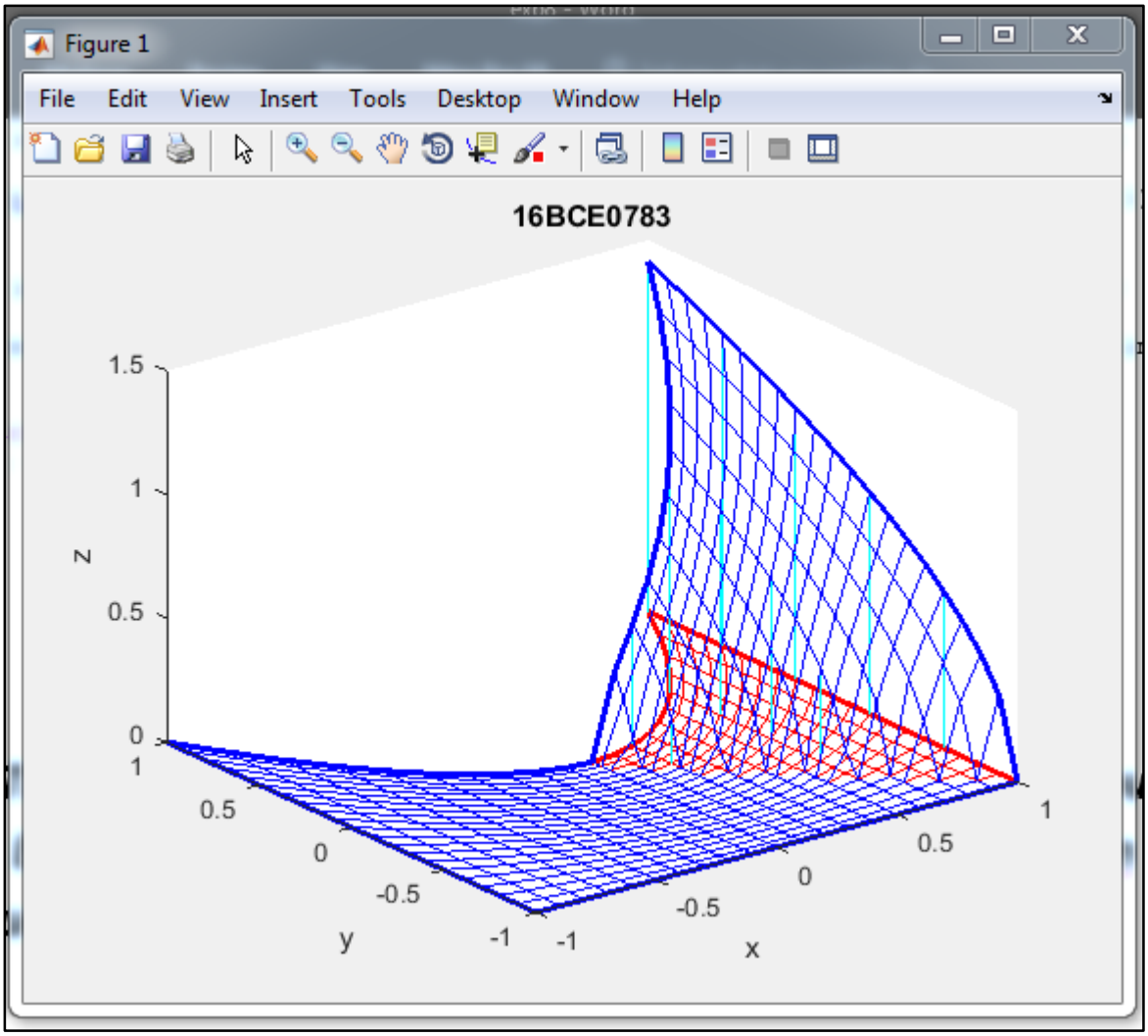
II. MATLAB Code for calculating and visualizing volume of a solid

```
%triple integrals
clc
clear all
syms x y z
zlim = input('z limits [z0 z1]: ');
ylim = input('y limits [y0 y1]: ');
xlim = input('z limits [x0 x1]: ');
if isa(ylim,'sym')
    %f = int(int(1,zlim(1),zlim(2)),x,xlim(1),xlim(2));
    %f = inline(f);
    %vol = quad(f,x,xlim(1),xlim(2));
    vol = int(int(int(1,z,zlim(1),zlim(2)),y,ylim(1),ylim(2)),x,xlim(1),xlim(2));

viewSolid(z,zlim(1)+(0*x*y),zlim(2)+(0*x*y),y,ylim(1)+(0*x),ylim(2)+(0*x),x,xlim(1),xlim(
2))
else
    vol = int(int(int(1,z,zlim(1),zlim(2)),y,ylim(1),ylim(2)),x,xlim(1),xlim(2));

viewSolidone(z,zlim(1)+(0*x*y),zlim(2)+(0*x*y),y,ylim(1)+(0*x),ylim(2)+(0*x),x,xlim(1),xl
im(2))
end
title('16BCE0783')
disp(['The volume of the solid is: ',char(vol)])
```

```
19 -     disp(['The volume of the solid is: ',char(vol)])
```

Command Window

```
Warning: Imaginary parts of complex X, Y, and/or Z arguments ignored
> In viewSolid>oldviewSolid (line 76)
  In viewSolid (line 34)
  In oct_21 (line 13)
Warning: Imaginary parts of complex X, Y, and/or Z arguments ignored
> In viewSolid>oldviewSolid (line 76)
  In viewSolid (line 34)
  In oct_21 (line 13)
Warning: Imaginary parts of complex X, Y, and/or Z arguments ignored
> In viewSolid>oldviewSolid (line 76)
  In viewSolid (line 34)
  In oct_21 (line 13)
The volume of the solid is: log(2*2^(1/2) + 3)/64 - (pi*1i)/64 + 2^(1/2)*(13/32 + 16i/15)
fx >>
```



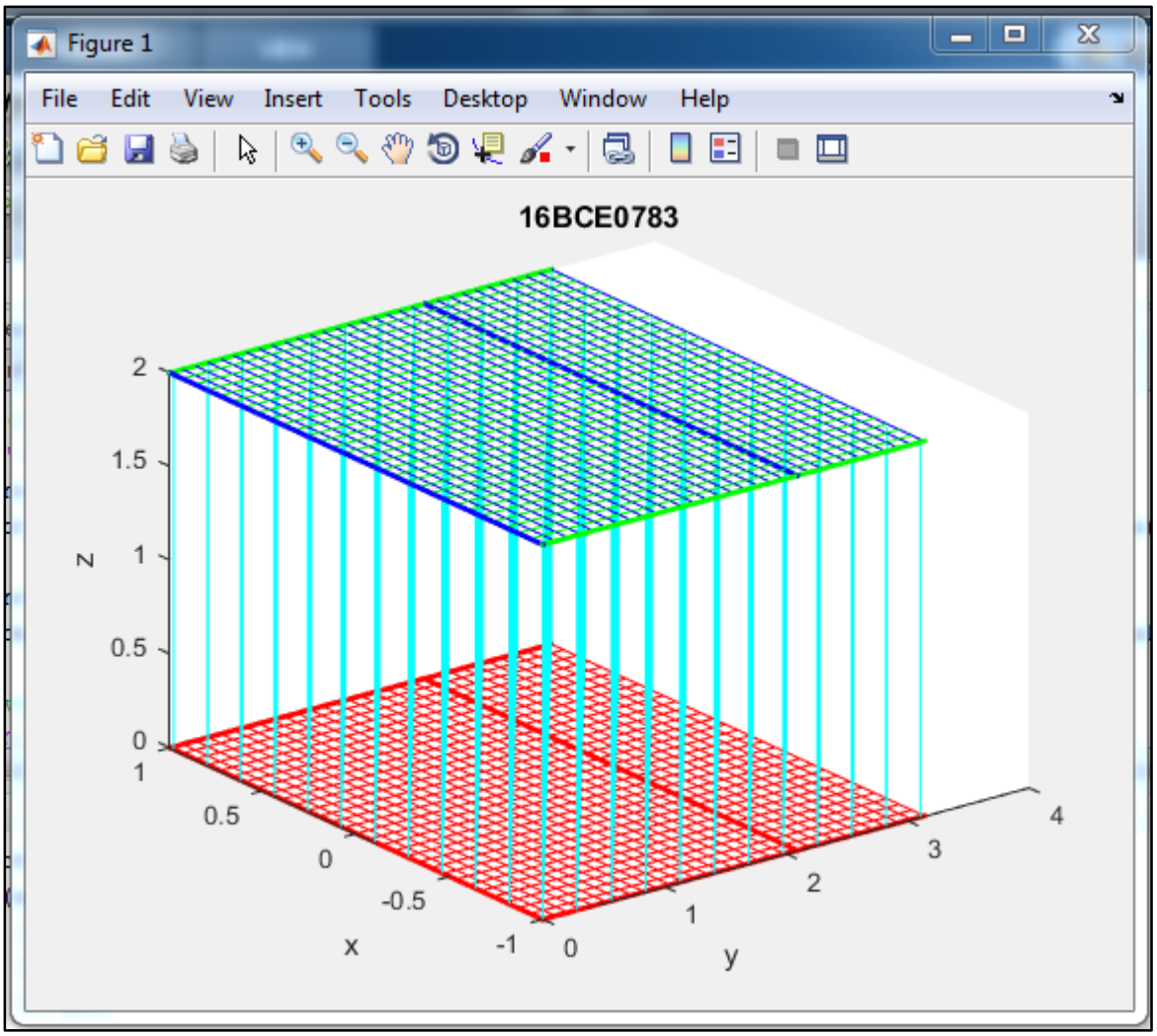
III. MATLAB Code for calculating mass of asteroid and amount of Kinetic Energy Released during Impact and it's comparision with earthquake

```
%asteroid
clc
clear all
syms x y z
v = input('Velocity at time of impact: ');
rho = input('Density at point (x,y,z): ');
zlim = input('z limits [z0 z1]: ');
ylim = input('y limits [y0 y1]: ');
xlim = input('z limits [x0 x1]: ');
if isa(ylim,'sym')
    mass = int(int(int(rho,z,zlim(1),zlim(2)),y,ylim(1),ylim(2)),x,xlim(1),xlim(2))   %or
vol =

viewSolid(z,zlim(1)+(0*x*y),zlim(2)+(0*x*y),y,ylim(1)+(0*x),ylim(2)+(0*x),x,xlim(1),xlim(
2))
else
    mass = int(int(int(rho,z,zlim(1),zlim(2)),y,ylim(1),ylim(2)),x,xlim(1),xlim(2))

viewSolidone(z,zlim(1)+(0*x*y),zlim(2)+(0*x*y),y,ylim(1)+(0*x),ylim(2)+(0*x),x,xlim(1),xl
im(2))
end
%disp(['The volume of the solid is: ',char(vol)])
title('16BCE0783')
disp(['The mass of object is ',num2str(double(mass)),' kg']);
KE = double(0.5*mass*v^2);
rict = double(log10(KE)+2.22/2.57);
disp(['The KE released in impact is ',num2str(KE),'equivalent earthquake
is',num2str(rict)])
```

```
17      %disp(['The volume of the solid is: ',char(vol)])
18 -    title('16BCE0783')
```

Command Window

```
Velocity at time of impact: 200
Density at point (x,y,z): 1000
z limits [z0 z1]: [0 2]
y limits [y0 y1]: [-1 1]
z limits [x0 x1]: [0 pi]

mass =

4000*pi

The mass of object is 12566.3706 kg
The KE released in impact is 251327412.2872equivalent earthquake is9.2641
fx >>
```



IV. Question - Answers:

Q1 Answer

Editor - D:\VIT\MATLAB\new\matlab\mass_calculate.m

asteroid.m | mass_calculate.m

```
1 -    clc
2 -    clear all
3 -    syms x y z
4 -    rho = input('Enter the density at the point (x,y,z): ');
5 -    zlim = input('Enter the z-limits as [z0 z1]: ');
6 -    ylim = input('Enter the y-limits as [y0 y1]: ');
7 -    xlim = input('Enter the x-limits as [x0 x1]: ');
8 -    if isa(ylim, 'sym')
9 -    mass = int(int(int(rho,z,zlim(1),zlim(2)),y,ylim(1),ylim(2)),x,xlim(1), xlim(2));
10 -   else
11 -       mass = int(int(int(rho,z,zlim(1),zlim(2)),x,xlim(1),xlim(2)),y,ylim(1), ylim(2));
12 -   end
13 -   disp(['The mass of the object is: ', num2str(double(mass)), ' kg.']);
```

Command Window

```
Enter the density at the point (x,y,z): 2*y + 5
Enter the z-limits as [z0 z1]: [0 1]
Enter the y-limits as [y0 y1]: [0 sqrt(2)]
Enter the x-limits as [x0 x1]: [0 1]
The mass of the object is: 9.0711 kg.
fx >>
```

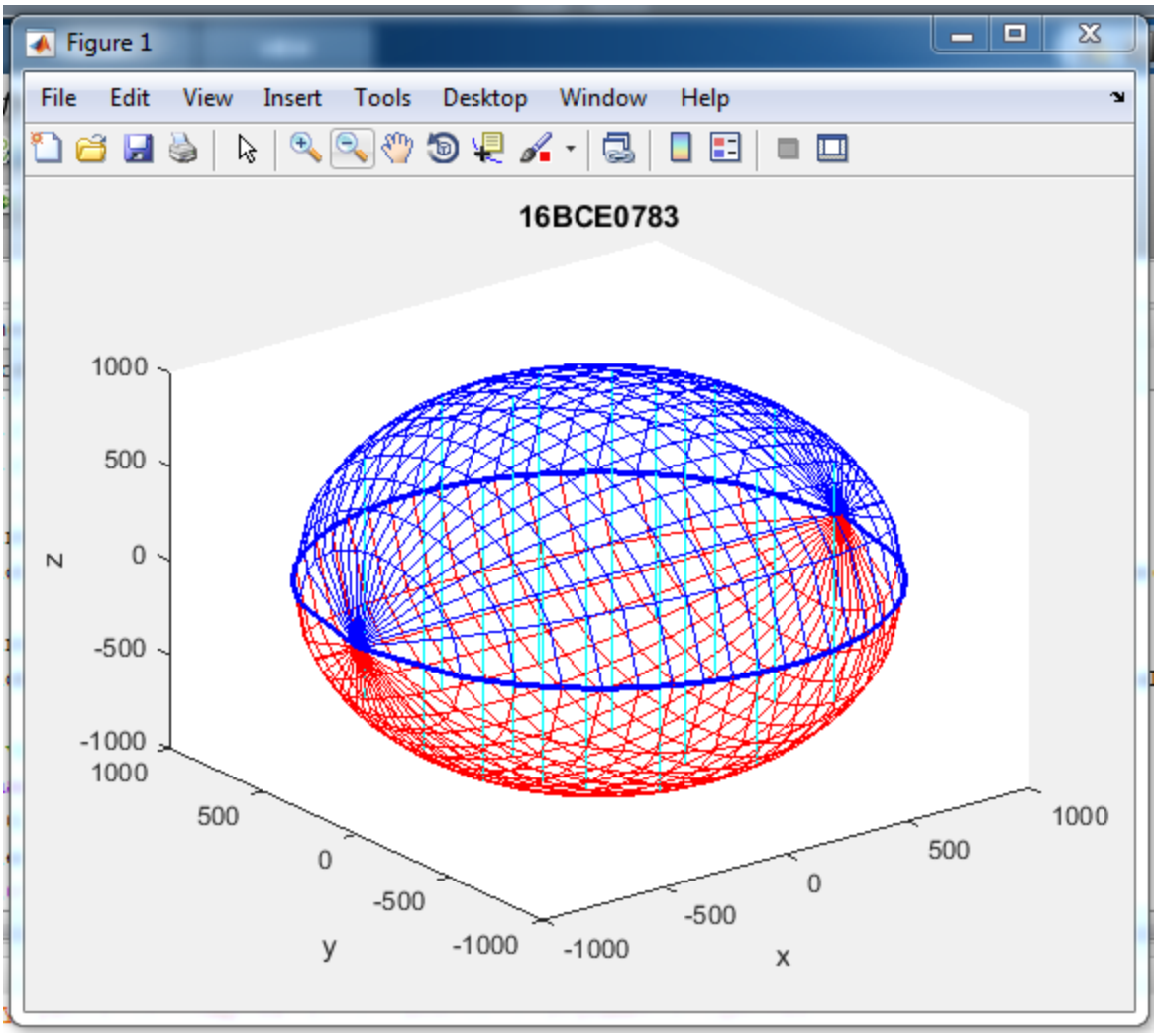
Q2 Answer

From the code written in section III, we have input and output as below:

Command Window

```
Velocity at time of impact: 40000
Density at point (x,y,z): 1380
z limits [z0 z1]: [-sqrt(1000^2-x^2-y^2) sqrt(1000^2-x^2-y^2)]
y limits [y0 y1]: [-sqrt(1000^2-x^2) sqrt(1000^2-x^2)]
z limits [x0 x1]: [-1000 1000]

mass =

1840000000000*pi

Warning: Imaginary parts of complex X, Y, and/or Z arguments ignored
> In viewSolid>oldviewSolid (line 51)
  In viewSolid (line 34)
fx
```

```
Command Window
> In viewSolid>oldviewSolid (line 70)
  In viewSolid (line 34)
  In asteroid (line 12)
Warning: Imaginary parts of complex X, Y, and/or Z arguments ignored
> In viewSolid>oldviewSolid (line 76)
  In viewSolid (line 34)
  In asteroid (line 12)
Warning: Imaginary parts of complex X, Y, and/or Z arguments ignored
> In viewSolid>oldviewSolid (line 76)
  In viewSolid (line 34)
  In asteroid (line 12)
The mass of object is 5780530482605.22 kg
The KE released in impact is 4.624424386084176e+21equivalent earthquake is9.2938
fx >>
```



----------X----------