21BDS0340

Abhinav Dinesh Srivatsa

Course Code: BMAT101L

Course Number: VL2021220106765

Course Slot: L9, L10

Digital Lab Assignment 4

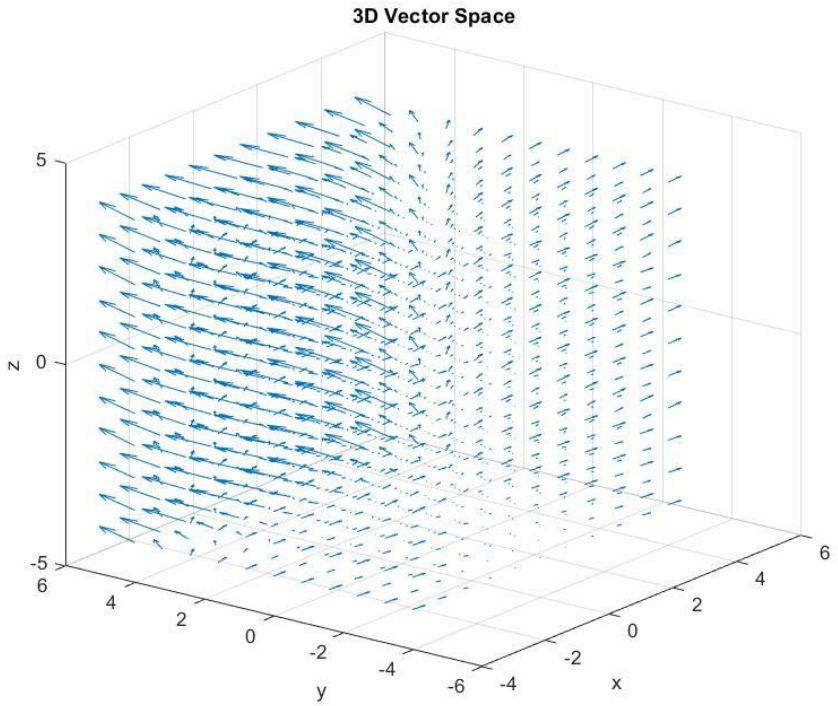
Problem 1

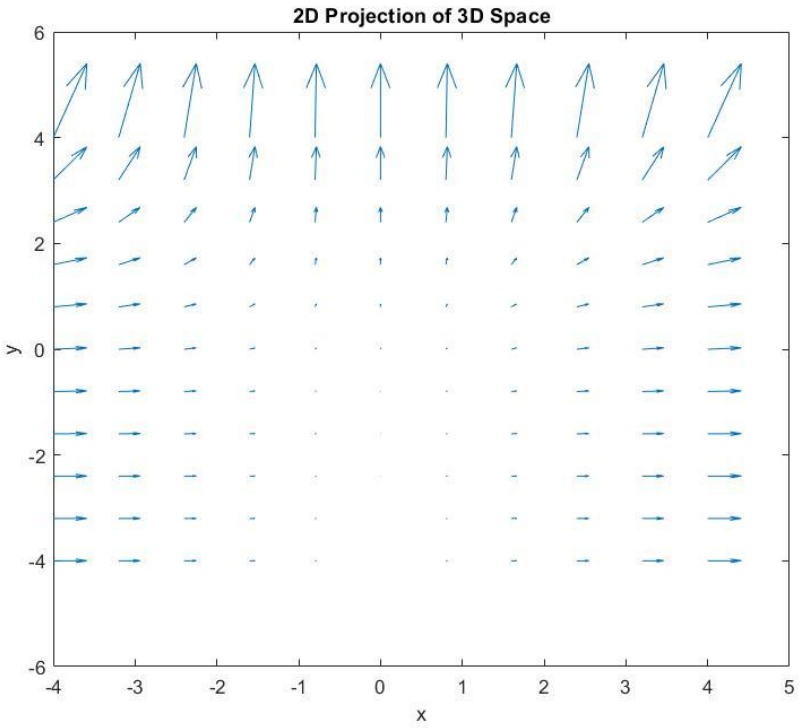
Draw the three-dimensional vector field for the vector F=icos(x^2)+jexp(y)+ksin(z^3) and visualize it.

Code:

```
syms x y z
f = [x^2, exp(y), sin(z^3)];
P(x, y, z) = f(1); Q(x, y, z) = f(2); R(x, y, z) = f(3);
x = linspace(-4, 4, 11); y = x; z = x;
[X, Y, Z] = meshgrid(x, y, z);
U = P(X, Y, Z); V = Q(X, Y, Z); W = R(X, Y, Z);
subplot(2,1,1)
quiver3(X, Y, Z, U, V, W, 2);
title('3D Vector Space')
xlabel('x'); ylabel('y'); zlabel('z');
subplot(2,1,2)
% for better visualisation
quiver(X, Y, U, V, 2);
title('2D Projection of 3D Space')
xlabel('x'); ylabel('y'); zlabel('z');
```

Output:





Problem 2

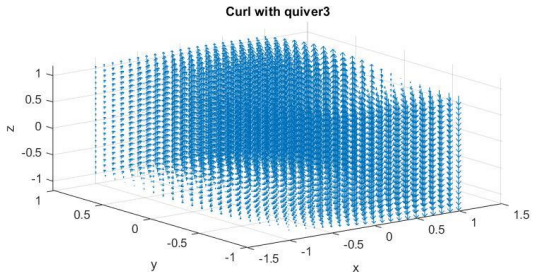
Find the curl of the vector field F = cos(x+2y)I + sin(x-2y)j and visualize it with following features:

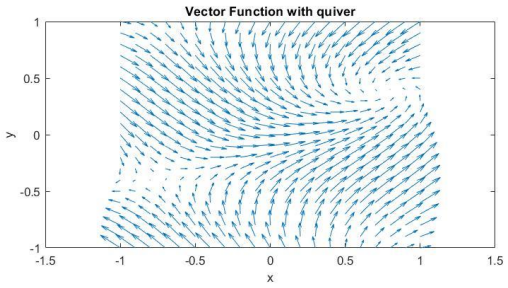
- Write Matlab code, Input & output.
- Use subplot for Figures\
  - 1st window: curl using quiver3
  - 2nd window: quiver
  - 3rd window: curl using surf function
  - 4th window: combined of pcolor & quiver functions.

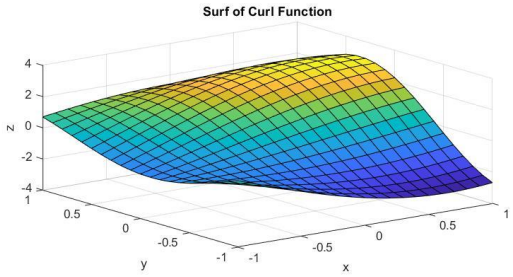
Code:

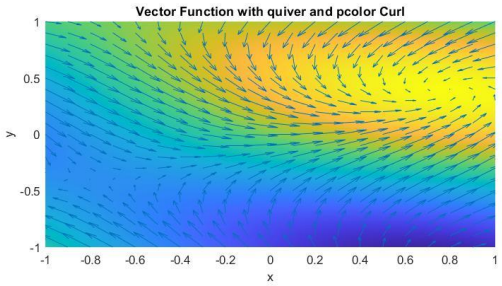
```
syms x y z
f = [cos(x + 2*y), sin(x - 2*y), 0*x*y*z];
P(x, y, z) = f(1); Q(x, y, z) = f(2); R(x, y, z) = f(3);
crl = curl(f, [x, y, z]);
C1(x, y, z) = crl(1); C2(x, y, z) = crl(2); C3(x, y, z) =
crl(3);
a = linspace(-1, 1, 21);
[X, Y, Z] = meshgrid(a, a, a);
CR1 = C1(X, Y, Z); CR2 = C2(X, Y, Z); CR3 = C3(X, Y, Z);
U = P(X, Y, Z); V = Q(X, Y, Z); W = R(X, Y, Z);
subplot(2,2,1)
quiver3(X, Y, Z, CR1, CR2, CR3, 2)
title('Curl with quiver3')
xlabel('x'); ylabel('y'); zlabel('z');
subplot(2,2,2)
quiver(X, Y, U, V, 2)
title('Vector Function with quiver')
xlabel('x'); ylabel('y');
subplot(2,2,3)
[X, Y] = meshgrid(a, a);
surf(X, Y, double(C3(X, Y, 0)))
title('Surf of Curl Function')
xlabel('x'); ylabel('y'); zlabel('z');
subplot(2,2,4)
pcolor(X, Y, C3(X, Y, 0))
shading interp
hold on
[X, Y, Z] = meshgrid(a, a, a);
quiver(X, Y, U, V, 2)
title('Vector Function with quiver and pcolor Curl')
xlabel('x'); ylabel('y'); zlabel('z');
```

Output:


Curl with quiver3
z
y
x


Vector Function with quiver
y
x


Surf of Curl Function
z
y
x


Vector Function with quiver and pcolor Curl
y
x