



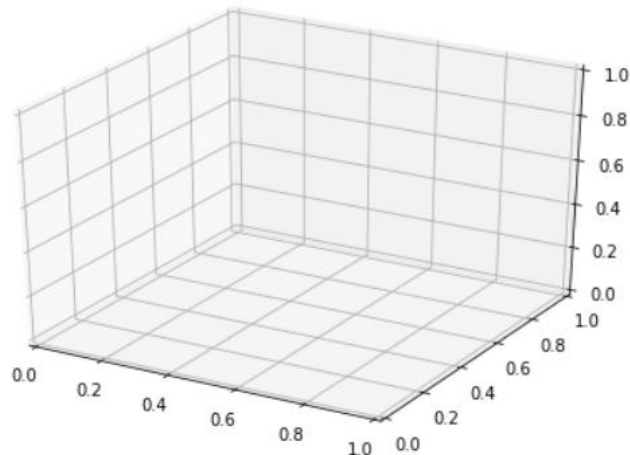
9.6.1 三维数据可视化

matplotlib工具集

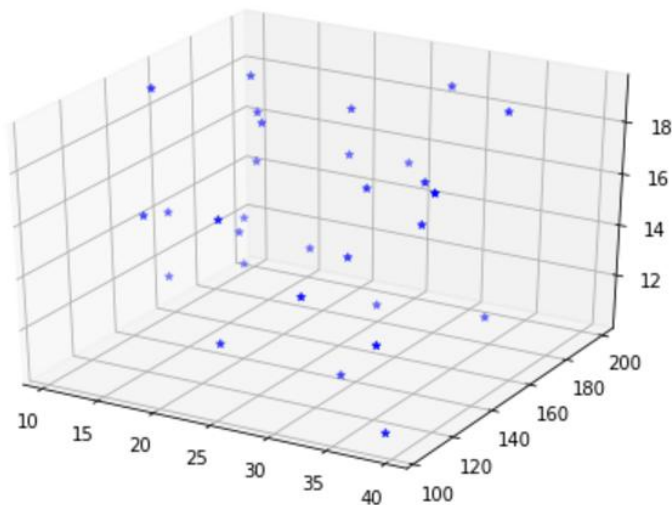
- 绘制三维图形
- 内置于Matplotlib
- Figure对象
- Axes3d对象

```
In [1]: import matplotlib.pyplot as plt  
        from mpl_toolkits.mplot3d import Axes3D
```

```
In [2]: fig=plt.figure()  
        ax3d = Axes3D(fig)  
        plt.show()
```



绘制散点图——随机点



In [3]:

```
import numpy as np
```

In [4]:

```
x=np.random.uniform(10, 40, 30)  
y=np.random.uniform(100, 200, 30)  
z=np.random.uniform(10, 20, 30)
```

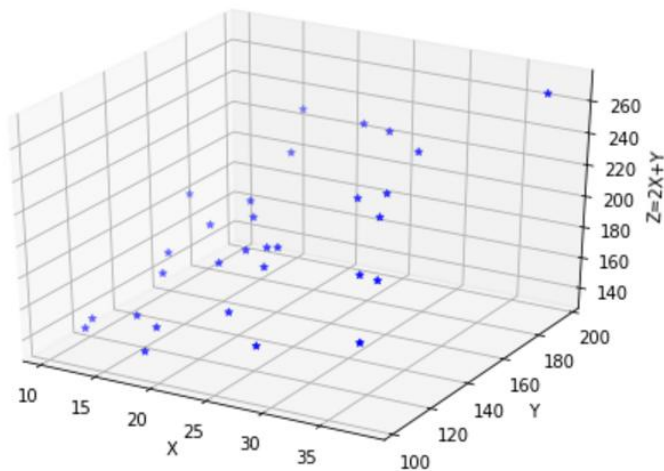
In [5]:

```
fig = plt.figure()  
ax3d = Axes3D(fig)  
ax3d.scatter(x, y, z, c='b', marker="*")  
plt.show()
```



9.6.1 三维数据可视化

绘制散点图—— $z=2x+y$



In [6]:

```
x=np.random.uniform(10, 40, 30)
y=np.random.uniform(100, 200, 30)
z=2*x+y
```

In [7]:

```
fig = plt.figure()
ax3d = Axes3D(fig)

ax3d.scatter(x, y, z, c='b', marker="*")

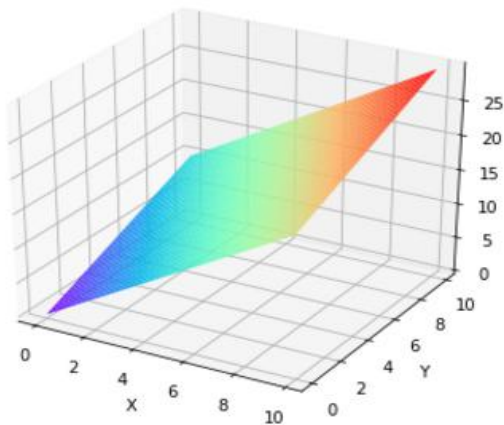
ax3d.set_xlabel('X')
ax3d.set_ylabel('Y')
ax3d.set_zlabel('Z=2X+Y')

plt.show()
```

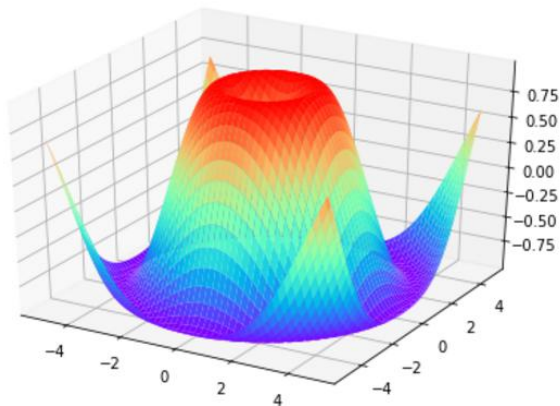


9.6.1 三维数据可视化

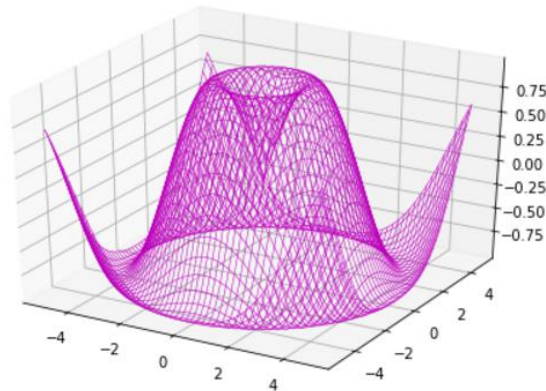
平面图



曲面图

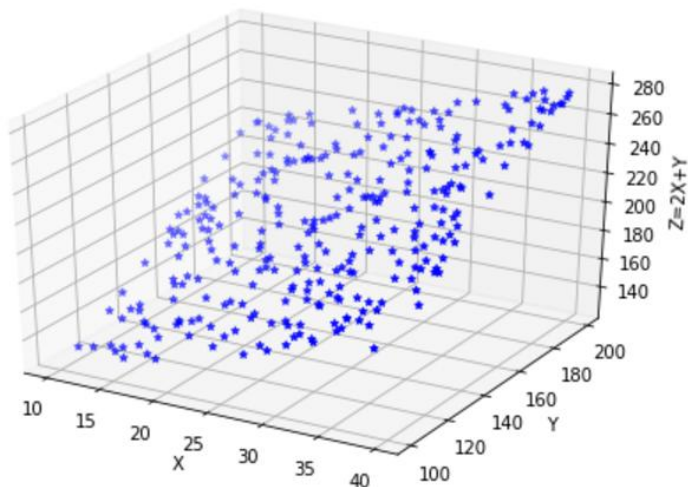


线框图



9.6.1 三维数据可视化

绘制散点图—— $z=2x+y$



In [8]:

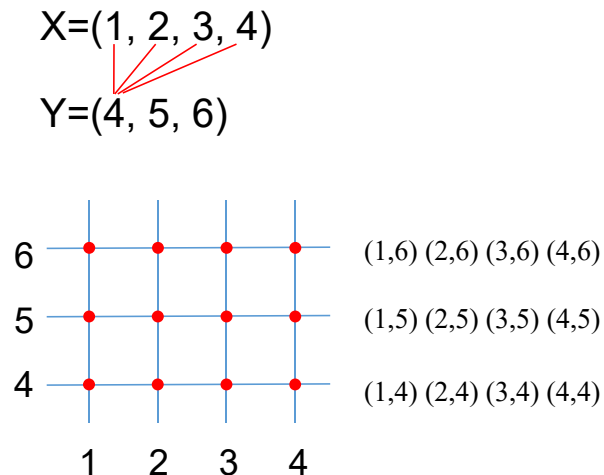
```
x=np.random.uniform(10,40,300)  
y=np.random.uniform(100,200,300)  
z=2*x+y
```

In [9]:

```
fig = plt.figure()  
ax3d = Axes3D(fig)  
  
ax3d.scatter(x, y, z, c='b', marker="*")  
  
ax3d.set_xlabel('X')  
ax3d.set_ylabel('Y')  
ax3d.set_zlabel('Z=2X+Y')  
  
plt.show()
```



网格点坐标矩阵



`np.meshgrid()`: 生成网格点坐标矩阵

```
In [10]: x=[1, 2, 3, 4]  
         y=[4, 5, 6]  
         X,Y=np.meshgrid(x,y)
```

```
In [11]: X
```

```
Out[11]: array([[1, 2, 3, 4],  
                [1, 2, 3, 4],  
                [1, 2, 3, 4]])
```

```
In [12]: Y
```

```
Out[12]: array([[4, 4, 4, 4],  
                [5, 5, 5, 5],  
                [6, 6, 6, 6]])
```



绘制平面图—— $z=2x+y$

```
In [13]: x=np.arange(1,5)  
         y=np.arange(1,5)  
         X,Y=np.meshgrid(x,y)
```

```
In [14]: X.shape,Y.shape
```

```
Out[14]: ((4, 4), (4, 4))
```

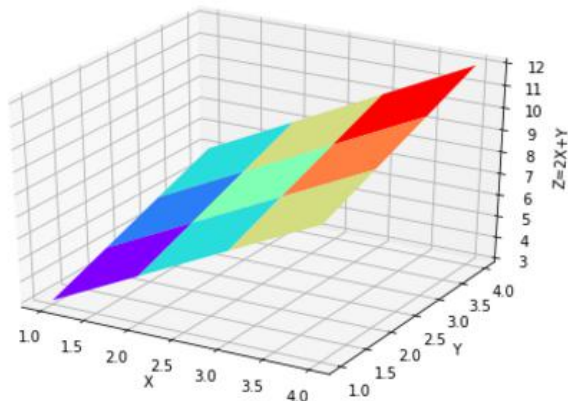
```
In [15]: Z=2*X+Y
```

```
In [16]: Z.shape
```

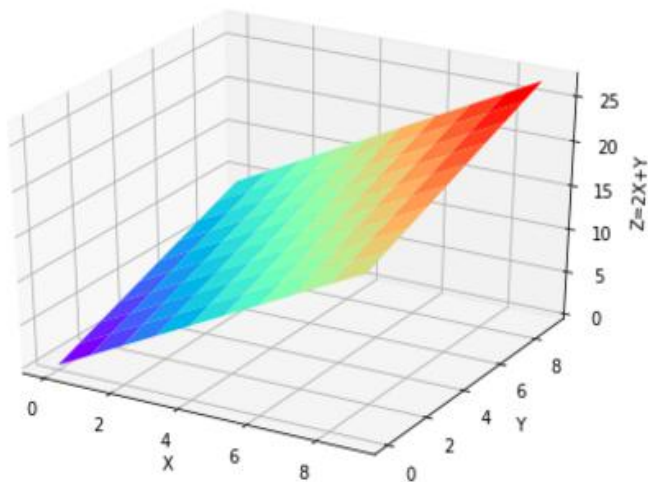
```
Out[16]: (4, 4)
```

plot_surface(): 绘制平面/曲面图

```
In [17]: fig = plt.figure()  
         ax3d = Axes3D(fig)  
  
         ax3d.plot_surface(X, Y, Z, cmap="rainbow")  
  
         ax3d.set_xlabel('X')  
         ax3d.set_ylabel('Y')  
         ax3d.set_zlabel('Z=2X+Y')  
         plt.show()
```



绘制平面图—— $z=2x+y$



```
In [18]: x=np.arange(0,10)
          y=np.arange(0,10)
          X,Y=np.meshgrid(x,y)
          Z=2*X+Y
```

```
In [19]: fig = plt.figure()
          ax3d = Axes3D(fig)

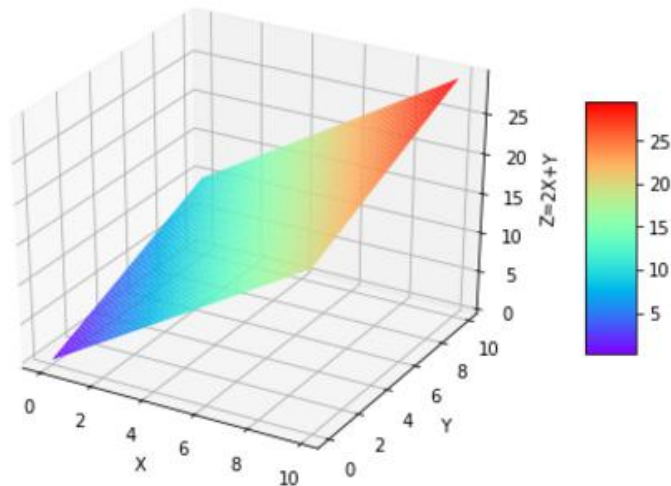
          ax3d.plot_surface(X,Y,Z,cmap="rainbow")

          ax3d.set_xlabel('X')
          ax3d.set_ylabel('Y')
          ax3d.set_zlabel('Z=2X+Y')
          plt.show()
```



9.6.1 三维数据可视化

绘制平面图—— $z=2x+y$



```
In [20]: x=np.arange(0,10,0.1)  
y=np.arange(0,10,0.1)  
X,Y=np.meshgrid(x,y)  
Z=2*X+Y
```

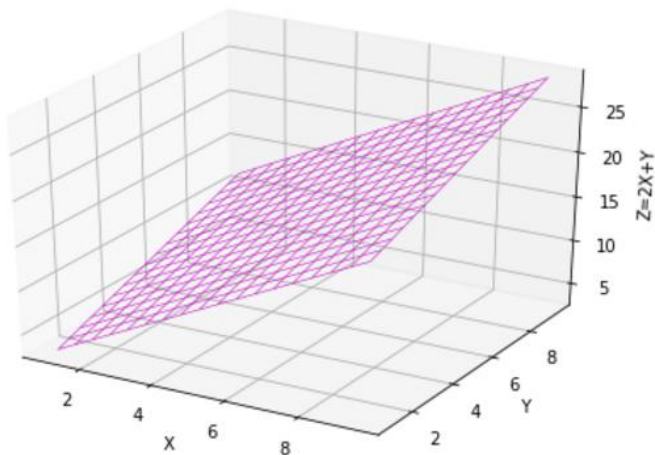
```
In [21]: Z.shape
```

```
Out[21]: (100, 100)
```

```
In [22]: fig = plt.figure()  
ax3d = Axes3D(fig)  
  
surf=ax3d.plot_surface(X,Y,Z,cmap="rainbow")  
fig.colorbar(surf, shrink=0.5, aspect=5)  
  
ax3d.set_xlabel('X')  
ax3d.set_ylabel('Y')  
ax3d.set_zlabel('Z=2X+Y')  
plt.show()
```



绘制线框图—— $z=2x+y$



plot_wireframe(): 绘制线框图

In [23]:

```
x=np.arange(1,10,0.5)
y=np.arange(1,10,0.5)
X,Y=np.meshgrid(x,y)
Z=2*X+Y
```

In [24]:

```
fig = plt.figure()
ax3d = Axes3D(fig)

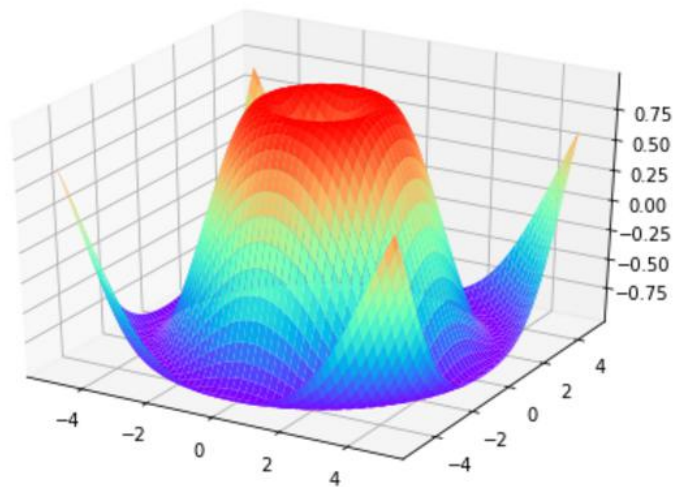
ax3d.plot_wireframe(X,Y,Z,color="m",linewidth=0.5)

ax3d.set_xlabel('X')
ax3d.set_ylabel('Y')
ax3d.set_zlabel('Z=2X+Y')
plt.show()
```



9.6.1 三维数据可视化

绘制曲面图—— $z = \sin \sqrt{x^2 + y^2}$



In [25]:

```
x=np.arange(-5,5,0.1)
y=np.arange(-5,5,0.1)
X,Y=np.meshgrid(x,y)
Z=np.sin(np.sqrt(X** 2+Y** 2))
```

In [26]:

```
fig = plt.figure()
ax3d = Axes3D(fig)

ax3d.plot_surface(X, Y, Z, cmap="rainbow")

plt.show()
```



绘制曲面的线框图

```
In [27]: fig = plt.figure()
ax3d = Axes3D(fig)

ax3d.plot_wireframe(X, Y, Z, color="m", linewidth=0.5)

plt.show()
```

