ESCI 386 – Scientific Programming, Analysis and Visualization with Python

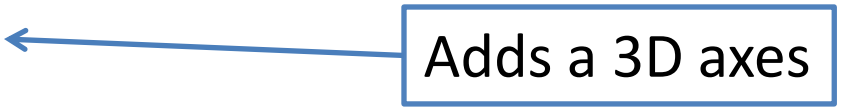
Lesson 16 - 3D Plots

`mpl_toolkits.mplot3d.axes3d`

- 3-D plotting is accomplished using the `mpl_toolkits.mplot3d.axes3d` module.
- The functionality of this module is not complete, but is a work-in-progress. Some features are not fully implemented.
- 3-D plots can be rotated and viewed from different angles.

3-D Spiral Example

```
import numpy as np
import matplotlib.pyplot as plt
import mpl_toolkits.mplot3d.axes3d as ax3d
z = np.arange(0,-100.0, -0.1)
x = np.exp(z/20.0)*np.cos(2*np.pi*z/20.0)
y = np.exp(z/20.0)*np.sin(2*np.pi*z/20.0)
fig = plt.figure()
a = ax3d.Axes3D(fig)
a.plot(x,y,z)
plt.show()
```



File: spiral.py

3-D Surface Plot

```
import numpy as np
import matplotlib.pyplot as plt
import mpl_toolkits.mplot3d.axes3d as ax3d
h = np.load('heights.npy')
shp = np.shape(h)
x = np.zeros_like(h)
y = np.zeros_like(h)
for i in range(0,shp[0]):
    for j in range(0, shp[1]):
        x[i,j] = i
        y[i,j] = j
fig = plt.figure()
a = ax3d.Axes3D(fig)
a.plot_surface(x,y,h,rstride = 5,cstride = 5)
plt.show()
```

File: surface-3D.py

3-D Wireframe Plot

```
import numpy as np
import matplotlib.pyplot as plt
import mpl_toolkits.mplot3d.axes3d as ax3d
h = np.load('heights.npy')
shp = np.shape(h)
x = np.zeros_like(h)
y = np.zeros_like(h)
for i in range(0,shp[0]):
    for j in range(0, shp[1]):
        x[i,j] = i
        y[i,j] = j
fig = plt.figure()
a = ax3d.Axes3D(fig)
a.plot_wireframe(x,y,h,rstride = 5,cstride = 5,linewidth = 0.5, color = '0.6')
a.contour(x,y,h,linewidth = 2)
plt.show()
```

File: wireframe-3D.py

Lines and Text Example

```
import matplotlib.pyplot as plt
import mpl_toolkits.mplot3d.axes3d as ax3d
import mpl_toolkits.mplot3d.art3d as a3d

# Create plot
fig = plt.figure()      # Create figure
ax = ax3d.Axes3D(fig)   # Create axes
ax.set_xlim(-3,3)
ax.set_ylim(-3,3)
ax.set_zlim(-3,3)

plt.show()
```

```
#  Draw a line
l = a3d.Line3D((1,1,2),(-3,0,-3),(-2,2,0),
     c = 'k', ls = '--')
ax.add_line(l)

# Plot text
ax.text(0,2,1,'Hello')
```

Import this module

x coordinates

y coordinates

z coordinates

x, y, and z coordinates

Lines and Text Result