**Introduction**

This report explains the Python code used to generate a 3D surface plot. The purpose of the code is to visualize a mathematical function Z=sin⁡(X2+Y2)Z = \sin(\sqrt{X^2 + Y^2})Z=sin(X2+Y2​) in three dimensions with customized colormaps and shading. The output highlights peaks and troughs of the function using gradients from a chosen colormap.

**Components of the Code**

1. **Libraries Used**:
   * numpy: For creating a grid of xxx and yyy coordinates and computing the mathematical function values.
   * matplotlib.pyplot: For plotting the 3D surface and managing colormap settings.
   * mpl\_toolkits.mplot3d: Provides the Axes3D module for rendering 3D plots.
2. **Key Steps**:
   * **Data Generation**:
     + Created a grid of xxx and yyy values using numpy.meshgrid().
     + Computed ZZZ values using the mathematical formula Z=sin(sqrt(X2+Y2)Z = \sin(\sqrt{X^2 + Y^2})Z=sin(X2+Y2​)).
   * **3D Plot Setup**:
     + Defined a Matplotlib figure and added a 3D subplot using fig.add\_subplot(111, projection='3d').
   * **Colormap and Shading**:
     + Applied the viridis colormap to enhance the visualization.
     + Disabled edge lines on the surface for smooth shading.
   * **Color Bar**:
     + Added a color bar to the plot for reference, mapping Z-values to colors.
   * **Labels and Title**:
     + Labeled the X, Y, and Z axes and added a descriptive title.

**Algorithm Explanation**

1. **Meshgrid Algorithm**:
   * The numpy.meshgrid() function generates a rectangular grid of X and Y coordinates over a specified range. These coordinates are used as input for the mathematical function.
2. **Mathematical Function**:
   * Z=sin⁡(X2+Y2)Z = \sin(\sqrt{X^2 + Y^2})Z=sin(X2+Y2​) computes the sine of the radial distance from the origin, creating a ripple e9ffect.
3. **Surface Plotting**:
   * The ax.plot\_surface() function renders the computed ZZZ-values as a continuous surface, applying the specified colormap.
4. **Shading and Colormap**:
   * The shading effect is achieved by disabling edge lines (edgecolor='none'), and the colormap visually differentiates areas of varying heights.