This Python script performs a series of calculations and visualizations related to the aerodynamics and structural dynamics of wind turbine blades. It uses the `numpy` and `matplotlib` libraries for numerical operations and plotting, respectively. Let's break down the code into its main components and explain each step:

1. \*\*Importing Libraries:\*\*

- `numpy` is imported for numerical operations.

- `os` is used to interact with the operating system, particularly for file path handling.

- `matplotlib.pyplot` is used for creating plots.

2. \*\*Setting the Working Directory:\*\*

- `os.chdir()` changes the current working directory to the specified path. This path is where the script will look for files and save outputs.

- `os.getcwd()` gets the current working directory and stores it in the variable `cwd`.

- `print(cwd)` prints the current working directory.

3. \*\*Loading Data:\*\*

- `bladestruc = np.loadtxt('bladestruc.txt')` loads data from a text file named 'bladestruc.txt' into a numpy array. This file likely contains structural information about the wind turbine blade.

4. \*\*Initializing Variables:\*\*

- `loads\_files` and `pitch\_angles` are lists containing filenames and pitch angles, respectively. These are used in subsequent calculations.

5. \*\*Defining Functions:\*\*

- `deflection()` calculates various parameters (like shear stress, bending moments, deflection angles) based on input loads, blade structure, and pitch angle.

- `nat\_freq()` calculates natural frequencies and mode shapes of the blade based on radius, structure, and pitch angle. It involves linear algebra operations like matrix multiplication and eigenvalue computation.

6. \*\*Main Loop:\*\*

- For each pair of `loads\_file` and `pitch\_angle`:

- Load data from the `loads\_file`.

- Convert some units (probably from kN to N).

- Call `deflection()` to calculate various parameters.

- Call `nat\_freq()` to get natural frequencies and mode shapes.

- Plot results using `matplotlib` for loads, shear stress, bending moments, bending stiffness, angles, deflections, and mode shapes. Each plot is configured with labels, titles, and legends.

7. \*\*Showing the Plots:\*\*

- `plt.show()` displays all the plots that were created in the loop.

Each function within the script (`deflection` and `nat\_freq`) contains more detailed calculations that are specific to the physics and engineering of wind turbine blades. The calculations involve iterating over data points, performing numerical integrations, and solving linear equations, all of which are typical in structural analysis. The final output is a series of plots that provide a visual representation of the loads, stresses, deflections, and vibrational characteristics of the wind turbine blades under various conditions.