CIL3060 Lab Project: Direct Stiffness Method

Project Overview

This project implements the Direct Stiffness Method for structural analysis of 2D frames using Python. It reads node and member data from CSV files and supports various loads and boundary conditions.

The core functionalities include:
- Reading geometry and loading data from CSV files
- Constructing stiffness matrices
- Handling different types of supports and settlements
- Solving the system using symbolic algebra
- Computing displacements and support reactions
- Comparing results with commercial tools like STAAD Pro

This work was done individually by Alok Godara (B22CI004).

Key Features

- Generalized code for any 2D frame (vertical/inclined)
- CSV input for modular structure
- Symbolic and numerical computation using SymPy and NumPy
- Supports multiple load types: point, UDL, UVL, trapezoidal
- Accounts for support settlements (bonus)
- Result comparison with STAAD Pro

Visualization and Output

All intermediate and final results, including member lengths, angles, local/global stiffness matrices, and final displacements, are printed in tabular format.

This makes the tool transparent and useful for educational purposes as well as validation of commercial tools.