Assignment 3: Truss optimization

Write a program that optimizes determinant & indeterminant 2D trusses

1. Download the zip file and unzip it to your google drive
2. Assuming the path folder is “/My Drive/MECE5397/Assignment03”
3. Open the trussFEM2D-template.ipynb on google

Steps

1. Import data (those 4 files)
2. Construct the adjacency matrix
3. Construct initial F, u array (the unknowns can be 0)
4. Identify the row numbers for the free DOF and for the prescribed DOF
5. Set up a linear programming problem
6. Obtain the correct member forces and optimized area
7. Calculate reaction forces
8. Plot the cross sections

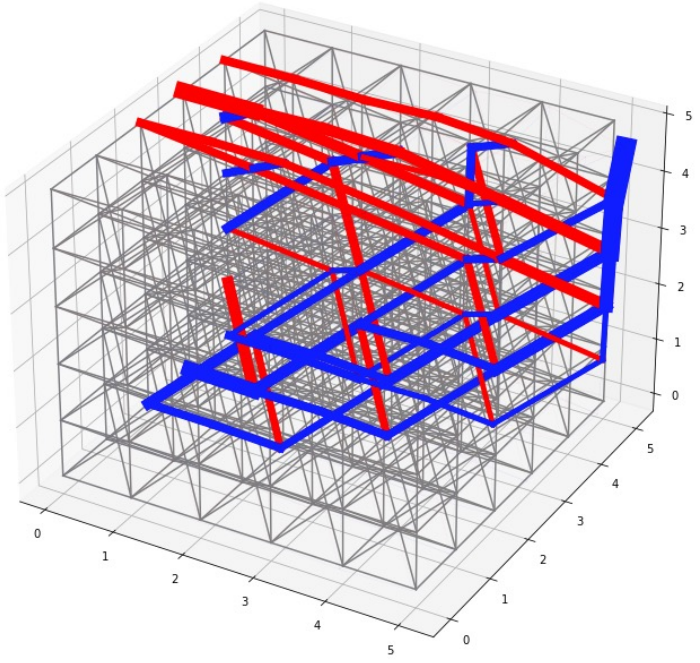
Test inputs

You are provided with three test files

7_bar - determinant

13_bar - indeterminant

3106_bar - indeterminant and large



Input files

nodes.csv

x0,y0

x1,y1

…

elements.csv

n0s,n0e

n1s,n1e

…

forces.csv

n0,x,y,F0

n1,x,y,F1

…

constraints.csv

n0,x,y,0

n1,x,y,0

…

x,y = 0 if free DOF

= 1 if prescribed DOF

Variables

glb – dict

elem – dict

num – dict

Rubric

Item	Grade
Code runs without any issues (before submitting, restart kernel and run all, save)	2.5
All the required functions are coded	2.5
Data imported without errors (the truss can be plotted)	2.5
The adjacency matrix is correct	2.5
The F array is correct	2.5
The free DOFs are correctly identified	2.5
The linear optimization works (on all test cases 1, 2, 3)	5
The resulting optimized cross sectional areas are correct	2.5
The member forces, f, are correct	1.25
The reaction forces are correct	1.25