SSB Static Analysis

Aim - To get familiar with Abaqus and MATLAB environment

Objective - Perform Stress analysis on a simply supported beam

Summary - This project enhanced my proficiency with MATLAB and Abaqus, allowing me to skillfully navigate from writing mathematical equations to generating graphical representations of results. I became adept with the Abaqus interface through practical simulation exercises, learning the essential steps to develop accurate simulation models. The comparison between MATLAB and Abaqus results highlighted certain discrepancies, attributable to the 1000-node limitation in the student version of Abaqus, which restricted the refinement of element sizes.

Details -
W= Load; M= BM; V= Shear force, L= Length
SSB beam left pinned support, right roller support

$-w = \int \frac{dV}{dx}$; $V = \frac{dM}{dx}$
$V = -\int w dx = -(wx) + C1$
$M = \int V dx = \int (-(wx) + C1) dx = \frac{-wx^2}{2} + C_1 x + C_2$

Apply Boundary Conditions

- at x=0 M=0 -> $C_2 = 0$
- at x=L M=0 -> $C_1 = \frac{WL}{2}$

Substitute constants in V & M eq.
$V = -(wx) + \frac{WL}{2}$
$M = \frac{-wx^2}{2} + \frac{WL}{2} x$

- Weight (W) = 200,000,000kN (UDL)
- Length (L) = 10m
- Width (b) = 1 m

- Height (h) = 2 m
- Global Seed Approximation = 0.4
- Elements generated = 375

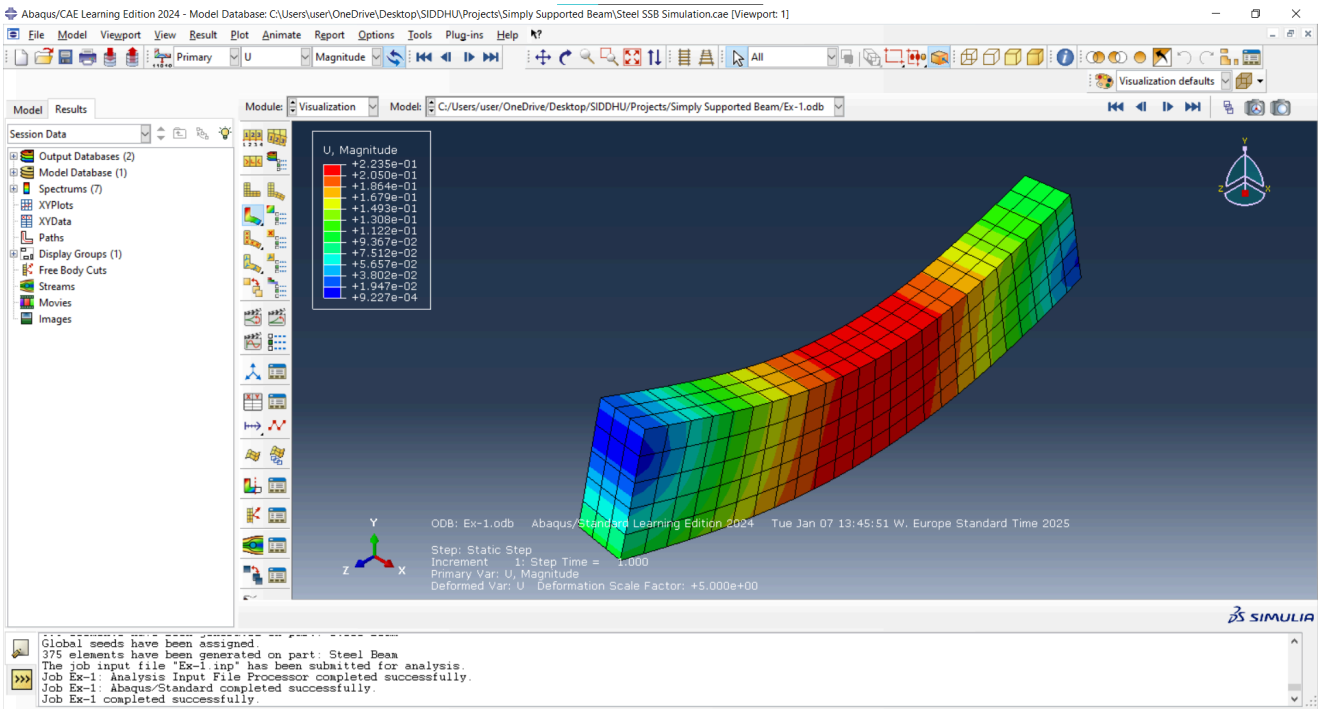
Abaqus results

1. Max stress = $3.122 * 10^9$ kN/meter
2. Max displacement = -0.2235 meters

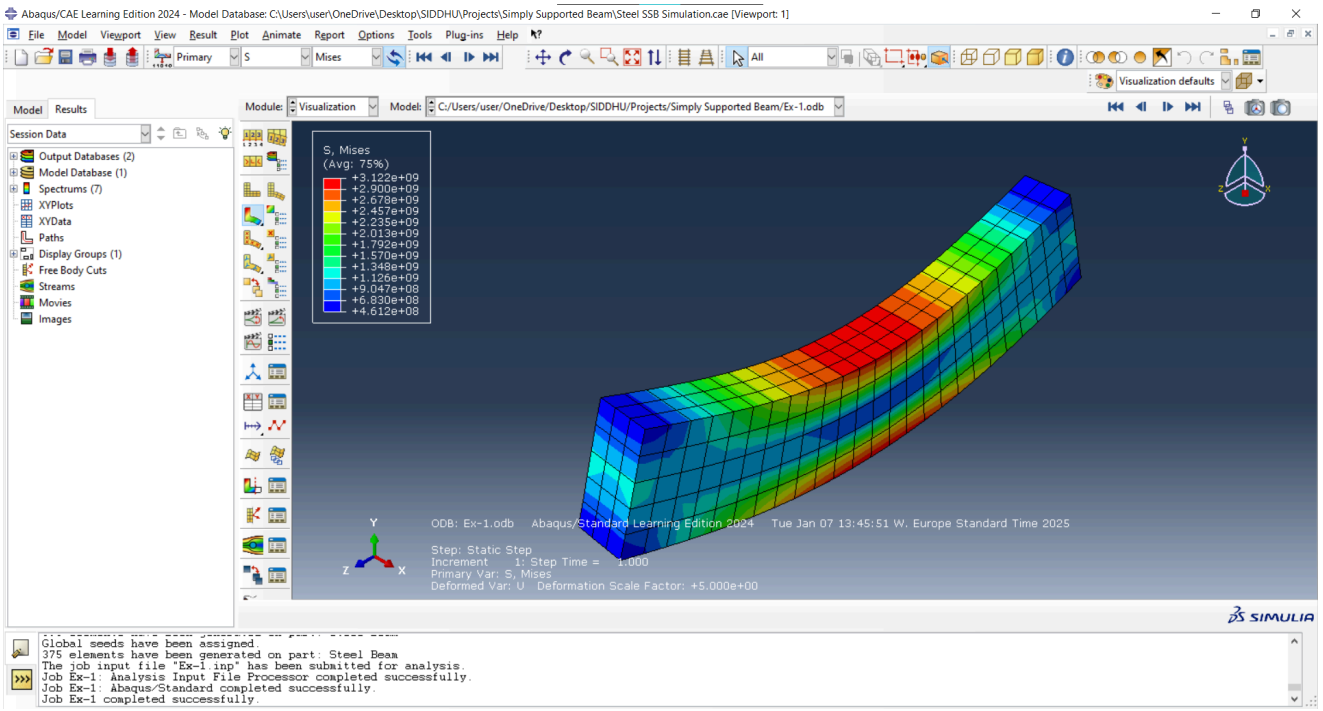
MATLAB results

1. Max displacement = -0.1952 meters
2. Max Bending Stress = $2.5 * 10^9$ kN-m
3. Shear Force = $+/- 1 * 10^9$ kN

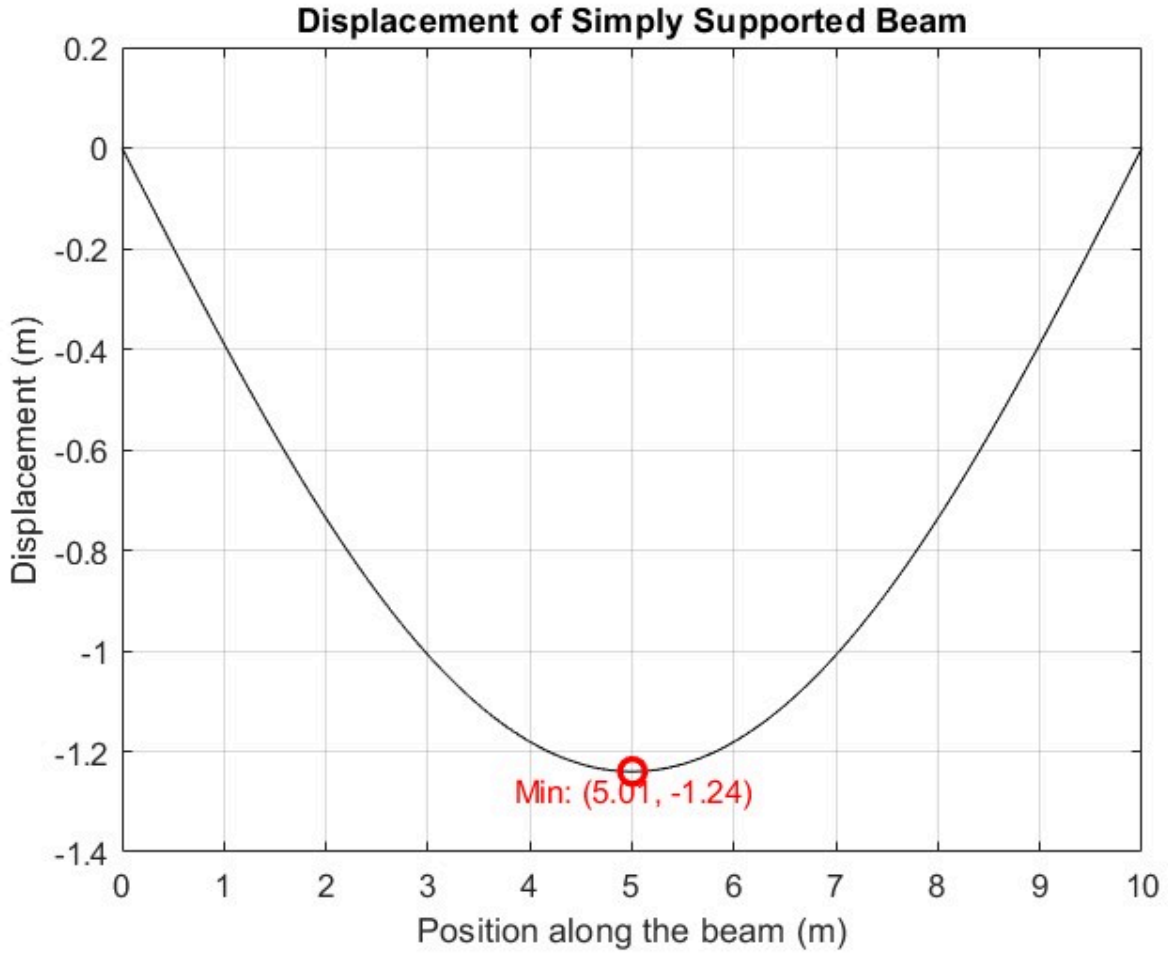
Displacement over the beam length

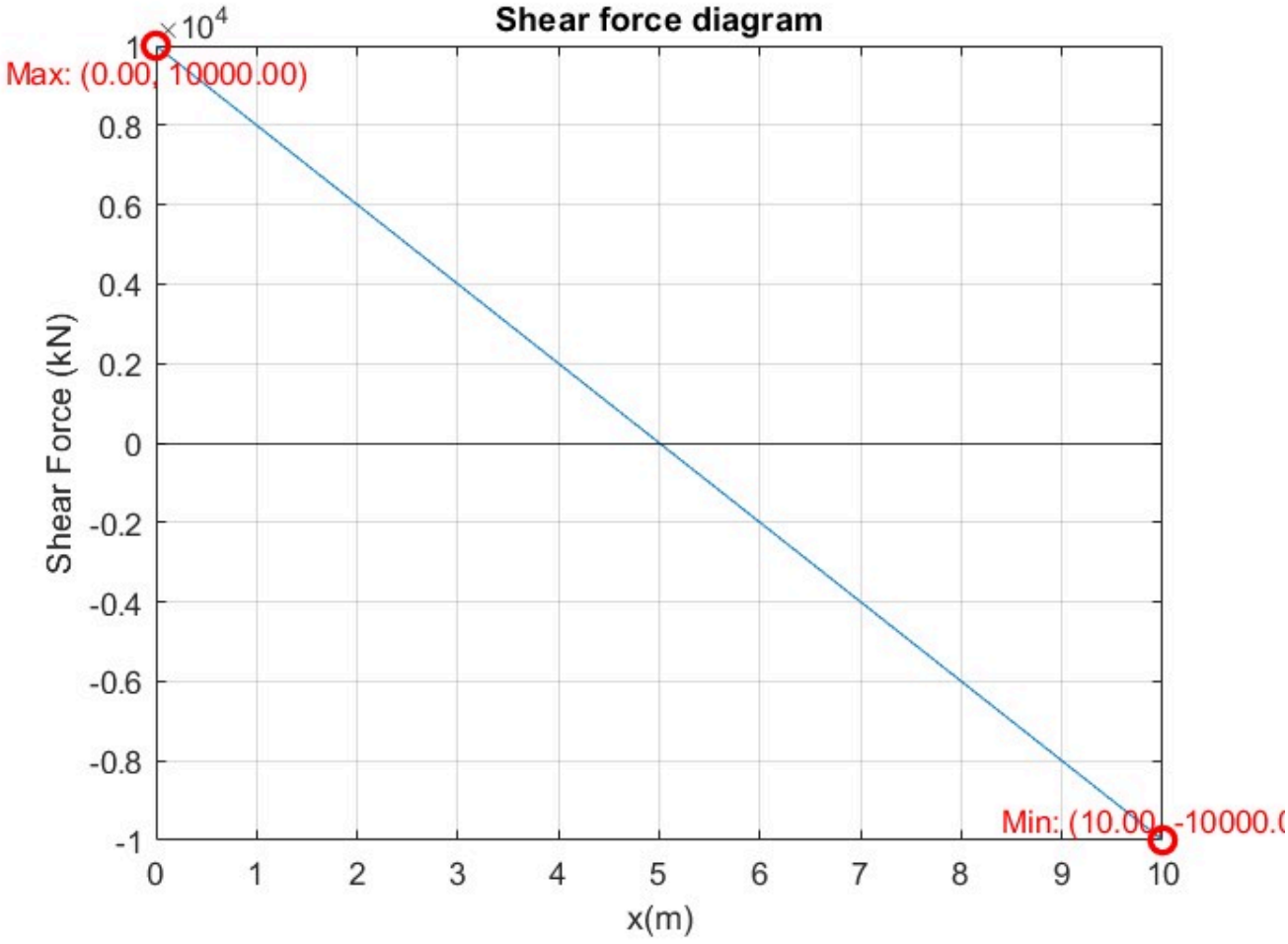


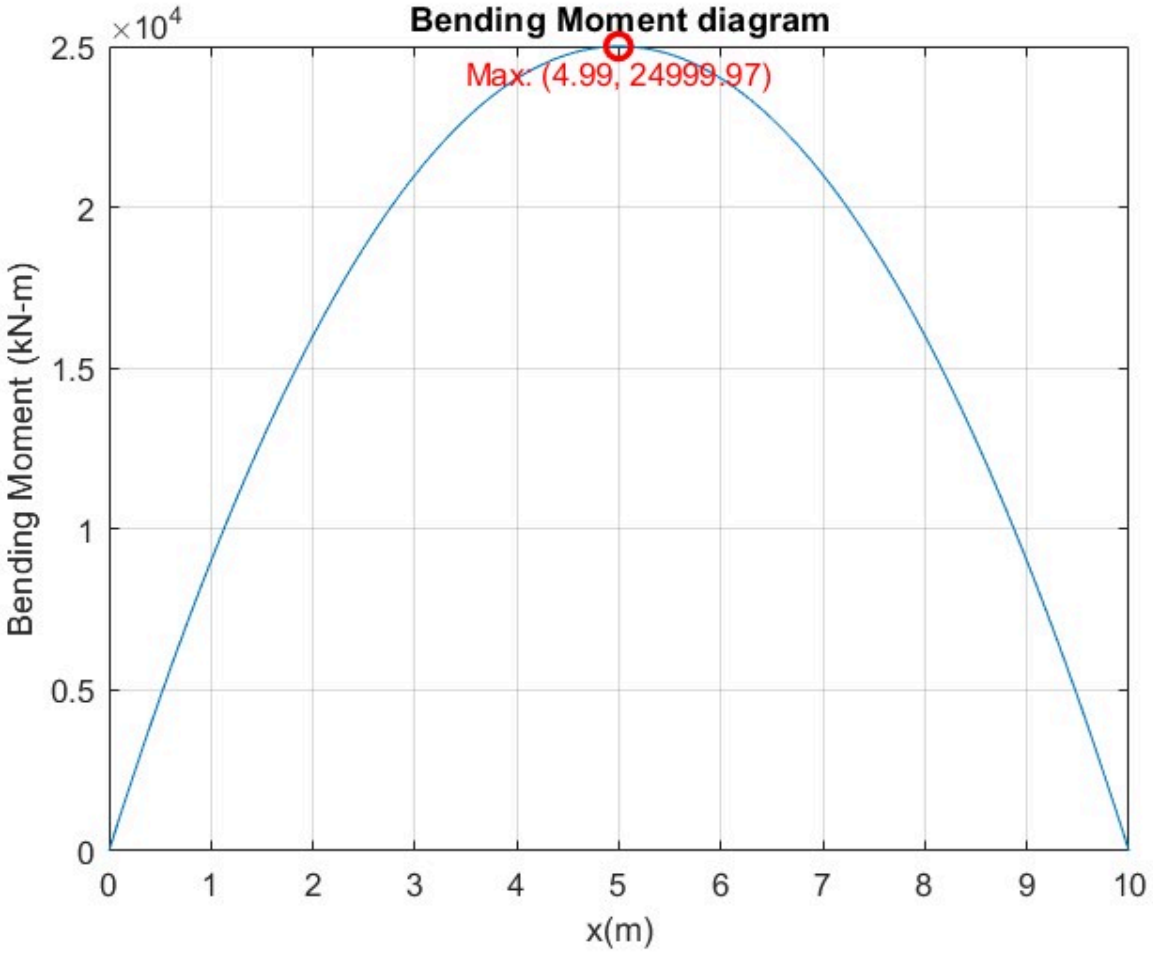
Stress Distribution over the beam



Results from MATLAB




Shear force diagram
×10^4
Max: (0.00, 10000.00)
Min: (10.00, -10000.0
Shear Force (kN)
x(m)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
1
2
3
4
5
6
7
8
9
10


Bending Moment diagram
Max: (4.99, 24999.97)
×10^4
2.5
2
1.5
1
0.5
0
Bending Moment (kN-m)
0
1
2
3
4
5
6
7
8
9
10
x(m)