CalculiX Simulation

For

Steel Specimen

Version 1.0

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Revision history

Version Number	Comments
1.0	Original Publication

1. Project Description

The project deals with simulation of a tension test on a specimen shown below. The dimensions of the specimen are 80mm x 25mm x 8mm.

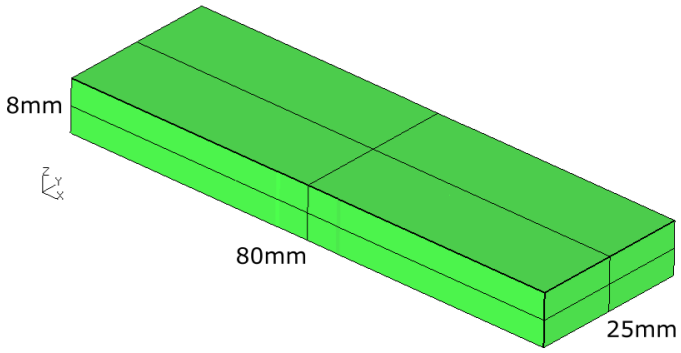


Figure 1: Specimen Dimensions

Since we have symmetry in the model, we will analyze 1/8th of the model as shown below.

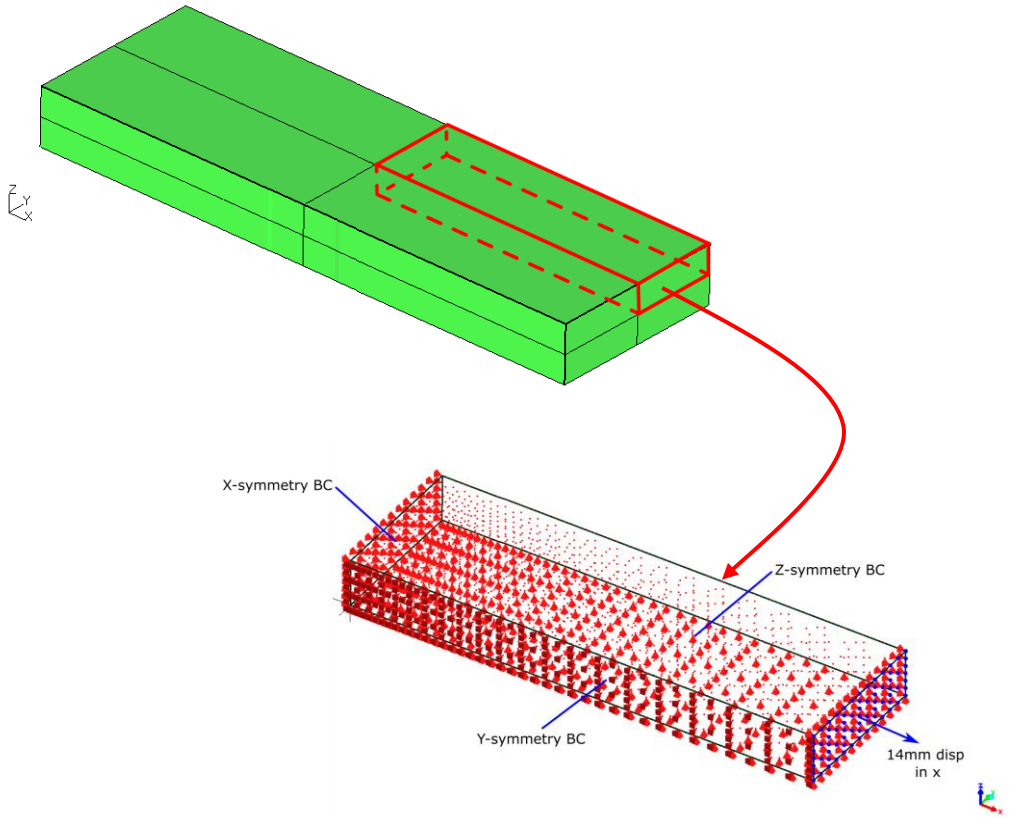


Figure 2: 1/8th symmetry model

2. Material Data

We are using Steel as or material

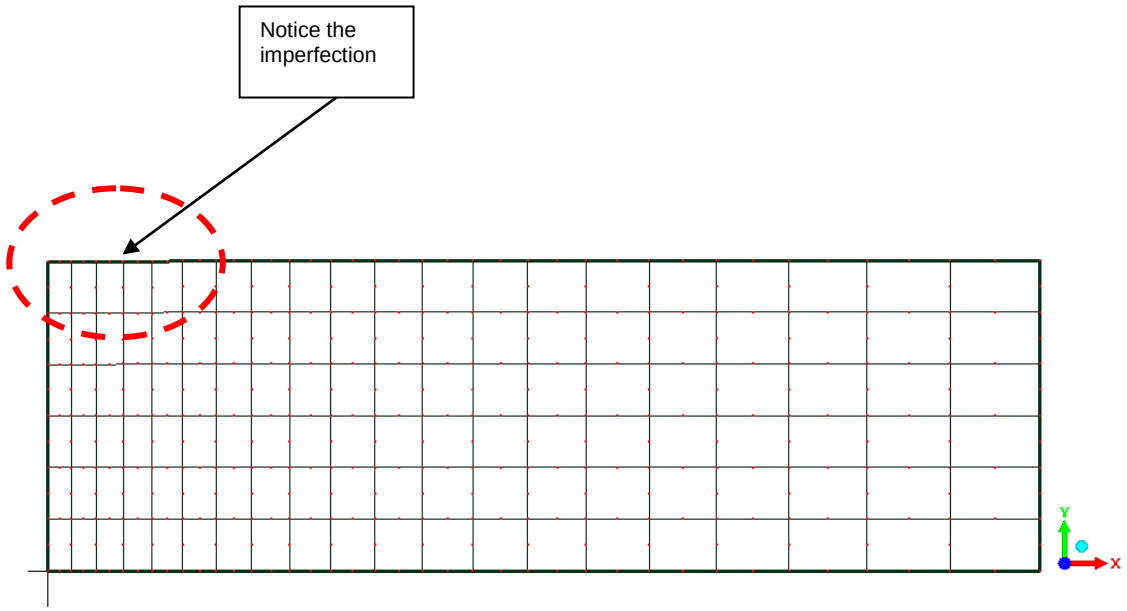
$$E = 210 \times 10^3 MPa$$

$$\nu = 0.3$$

Stress	Strain
330	0.00
335	0.02
400	0.04
480	0.08
540	0.15
585	0.24
1000	1.00

3. Imperfection for necking

In order to see necking in the section, we move a few nodes in the negative y-direction as shown below. This is taken care of in the preprocessing and the resulting mesh HAS this imperfection included.



4. Results

The following plot shows the load vs deflection plot.

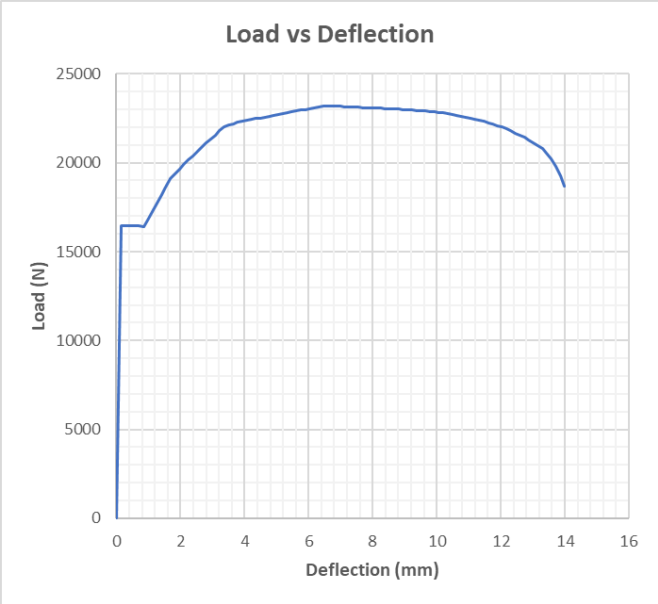


Figure 3: Load cs Deflection

We know the cross-sectional area of the specimen over which the load acts is 12.5mm x 4mm = 50mm^2. Thus, stress can be calculated using stress = Load/area. The deflection is in the x-direction where the length is 40mm. Thus strain = deflection/length. Using this, we can plot the stress vs strain plot as below.

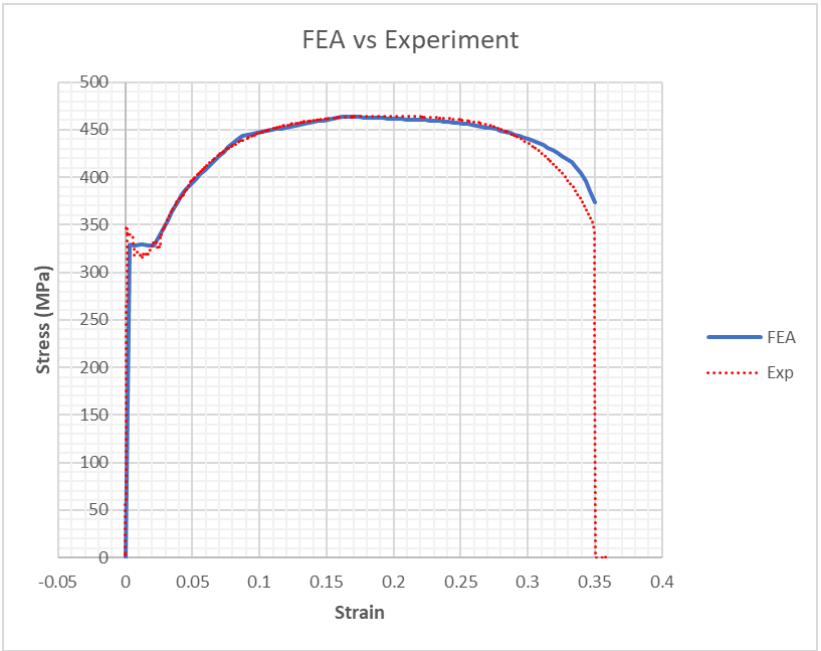


Figure 4: Stress vs strain plot

The zoomed in picture at very small strain is shown below

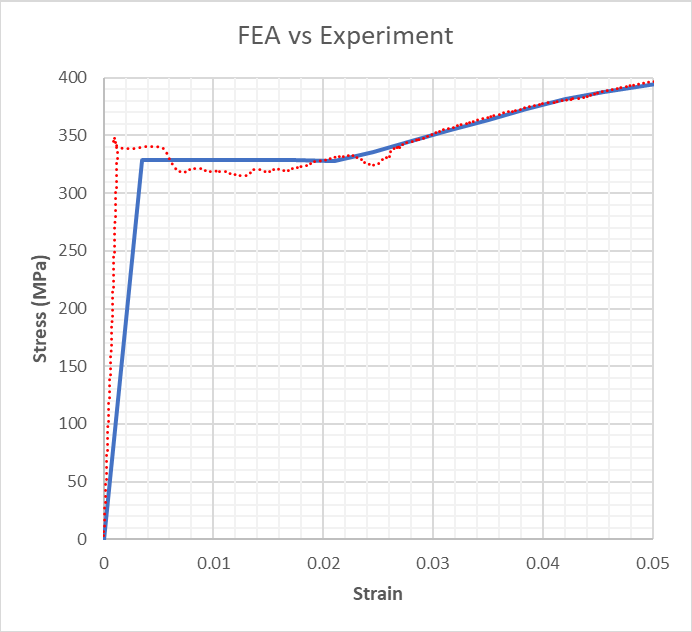


Figure 5: Stress vs strain at small strains

The von misses plot at the strain of 0.35 is shown below

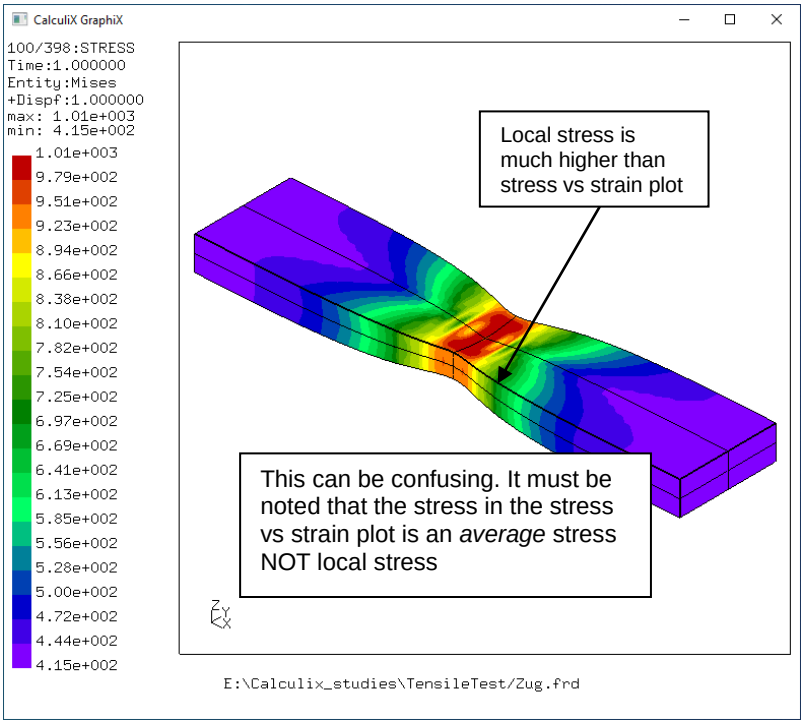


Figure 6: Von mises stress at final step