

Pressure Load on Rectangular block

Sanka Dasanayaka

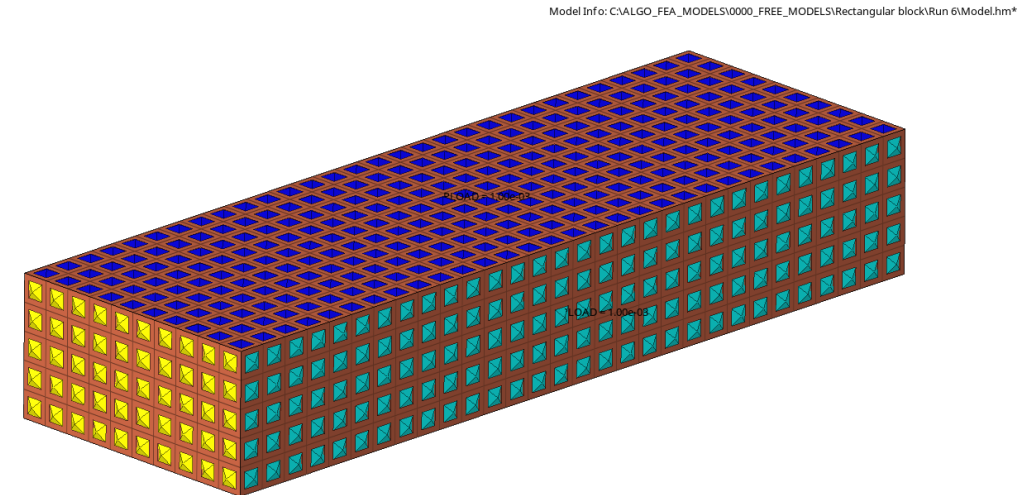
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ALGO
Engineering
Simplifying FEA

Model Description

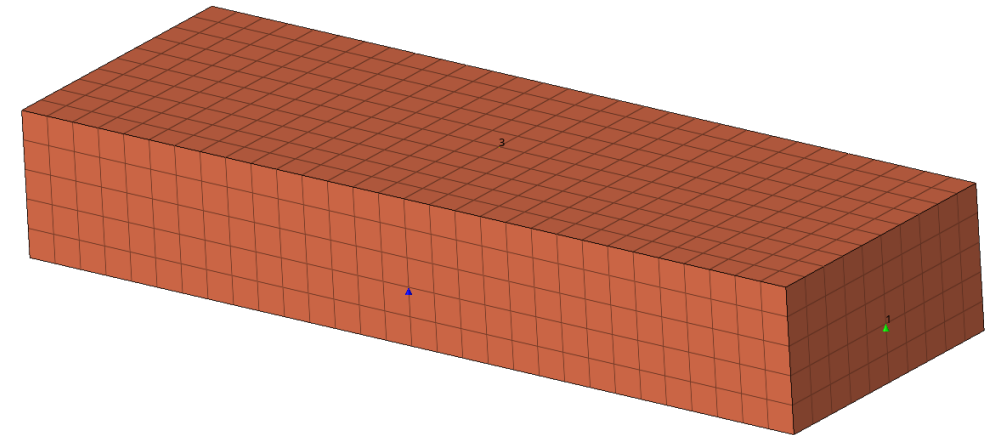
- Pressure loads on rectangular block based on example question 1 documented in page 122 of the following book:
 - J. Souza, *Roark's Formulas For Stress And Strain-.pdf*. Accessed: Nov. 06, 2022. [Online]. Available: https://www.academia.edu/37205286/Roarks_Formulas_For_Stress_And_Strain_pdf
- As mentioned in the book, steel is used in this model.



Model Description

- Length - 12 in (304.8 mm)
- Height - 4 in (101.6 mm)
- Thickness - 2 in (50.8 mm)
- Young's modulus - 30000000 lb/in² (206.8427184 GPa)
- Poisson's ratio - 0.3

Model Info: C:\ALGO_FEA_MODELS\0000_FREE_MODELS\Rectangular block\Run 6\Model.hm*



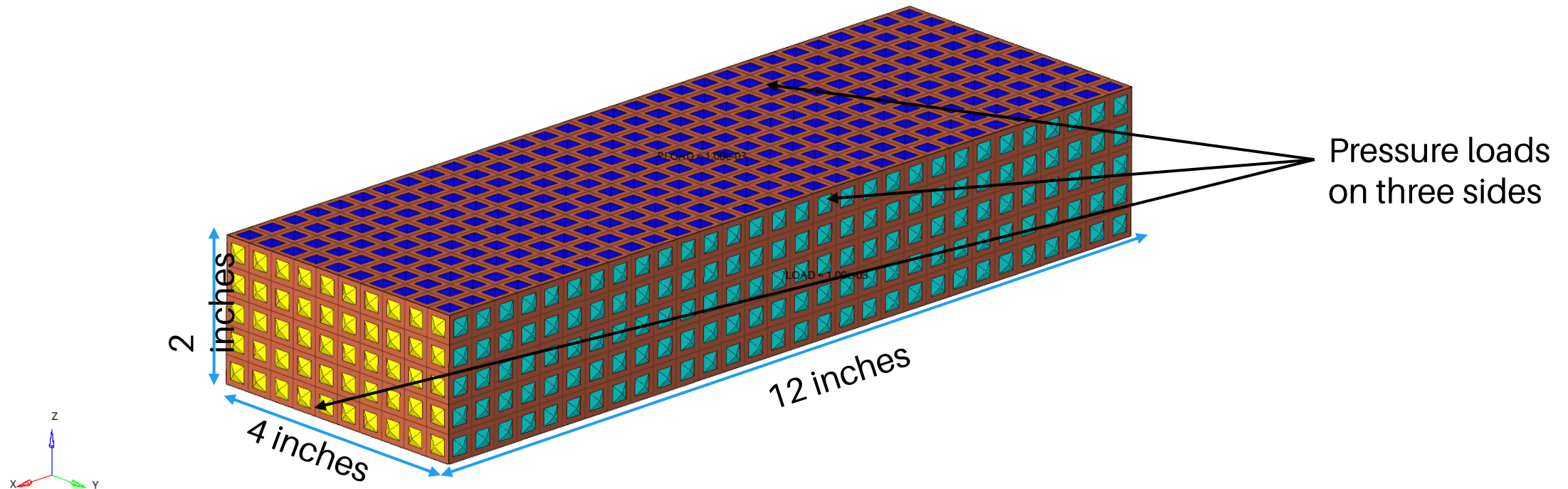
Model Parameters

Entity	Type
Solver	Altair Radioss
Version	2021.2.1
Processors	2
Threads	2
CPU	Intel(R) Core(TM) i7-9750H CPU @ 2.60GHz
Total run time	1 sec

FEA Entities	Type
Analysis Type	Dynamic Explicit
Unit System	Kg, mm, ms
Element Type	HEXA8N
Material Type	M1_ELAST
Property Type	P14_SOLID

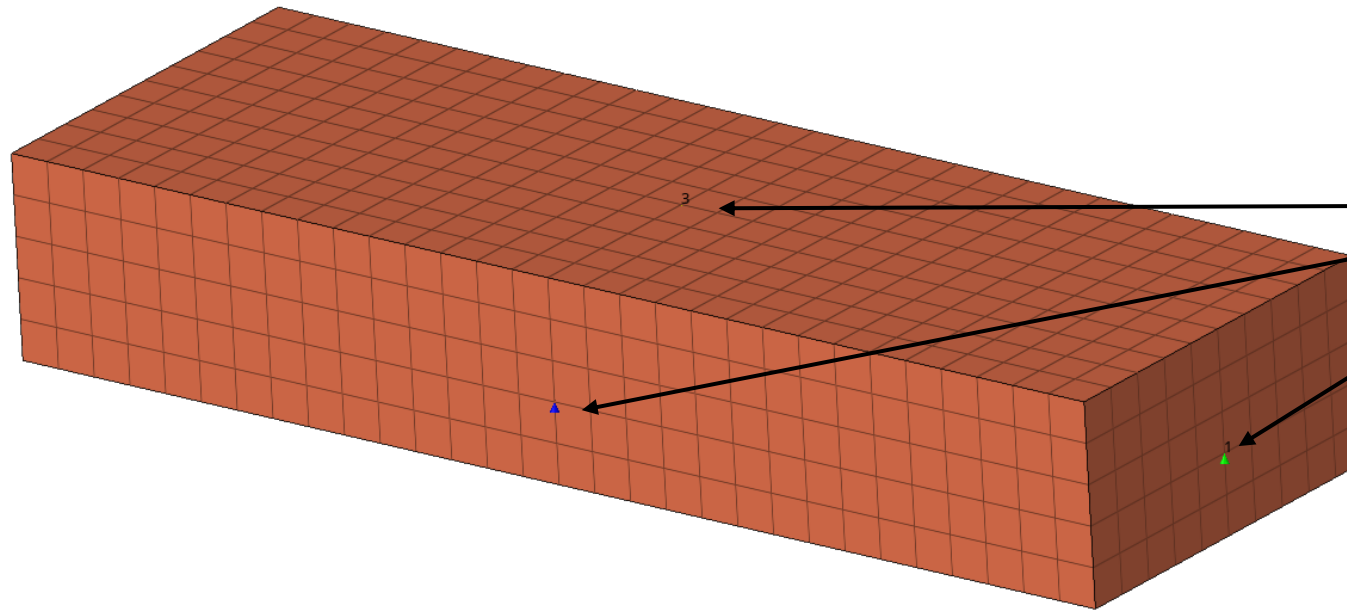
Analysis Setup

Model Info: C:\ALGO_FEA_MODELS\0000_FREE_MODELS\Rectangular block\Run 6\Model.hm*



Analysis Setup cont.

Model Info: C:\ALGO_FEA_MODELS\0000_FREE_MODELS\Rectangular block\Run 6\Model.hm*



Restrictions on translation in each direction

Analysis Assumptions and Limitations

- Standard density value of steel is assumed.
- The FEA analysis is performed dynamically (as in loading is applied very fast) since we are using the explicit Radioss solver.

Hand Calculations

ε – Strain

σ – Stress

E – Young's modulus

ν – Poisson's ratio

$$\varepsilon_{longitudinal} = \frac{\sigma_{longitudinal}}{E} - \frac{\sigma_{lateral}}{E} - \frac{\sigma_{vertical}}{E}$$

$$\varepsilon_{longitudinal} = \frac{12000}{E} - \frac{-15000}{E} - \frac{-9000}{E}$$

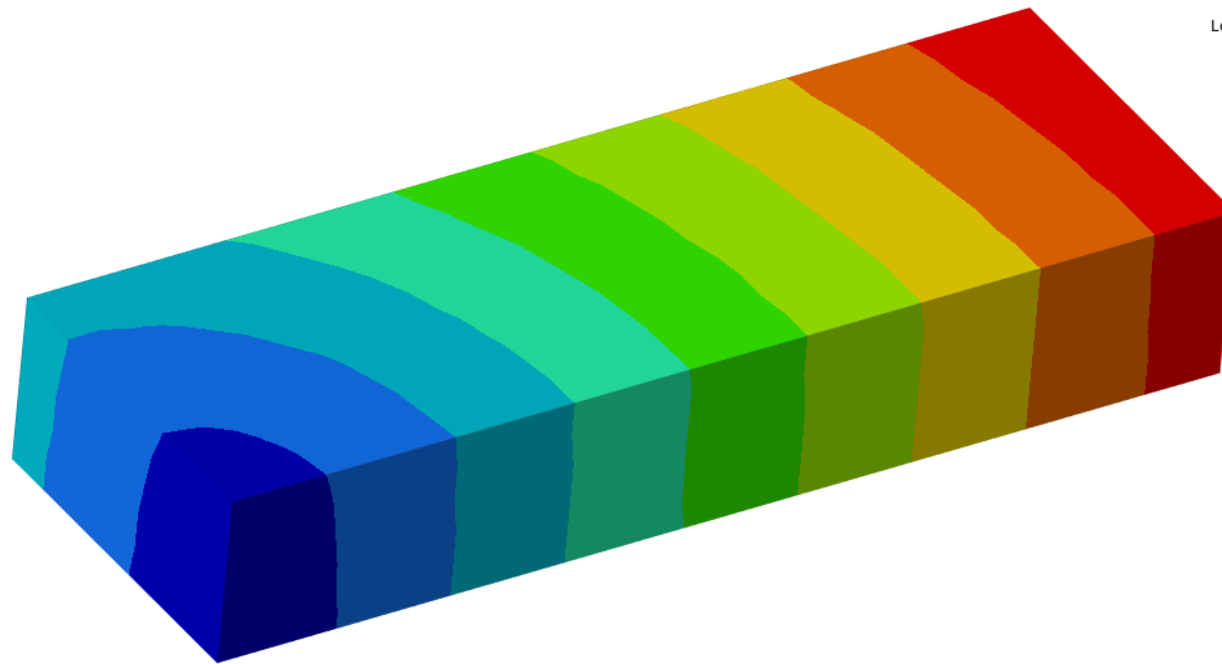
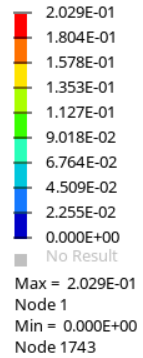
$$\varepsilon_{longitudinal} = 0.00064$$

$$elongation = 12 \times 0.00064 = 0.00768 \text{ in (0.195 mm)}$$

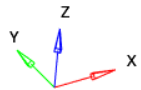
Analysis Results

Units - mm

Contour Plot
Displacement(Mag)
Analysis system



1: Model
Loadcase 1 : Time = 1.0000e+03 : Frame 101



Conclusions

- Pressure loads on rectangular block conducted using Altair Radioss based on the book listed in slide 2.
- Results of the simulation correlate well to the expected hand calculation value.

Elongation based on hand calculations – 0.00768 in (0.195 mm)

Elongation from the simulation - 0.00799 in (0.2029 mm)