Aluminum 2024-T4 Three Point Bending

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Model Description

- 3-pt bending analysis based on experiments documented in the following paper:
    - M.Z. Xing, Y.G. Wang, Z.X. Jiang, "Dynamic fracture behaviors of selected aluminum alloys under three-point bending", Def Technol, 9 (4) (2013), pp. 193-200
    - Dynamic Fracture Behaviors of Selected Aluminum Alloys Under Three-point Bending – ScienceDirect

- Analysis conducted for Aluminum 2024-T4 at 2.44 m/s impactor velocity

- Force response compared to test data documented in paper

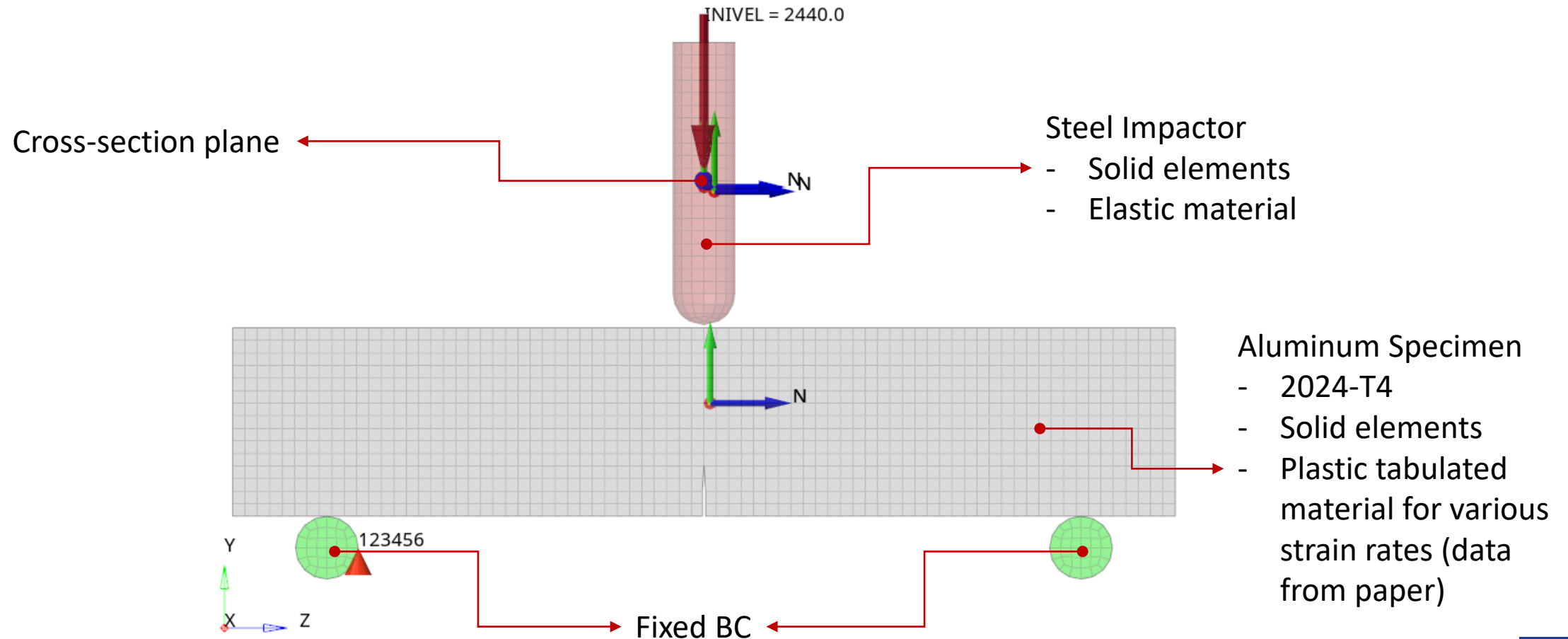- Note: This analysis does not model material failure.
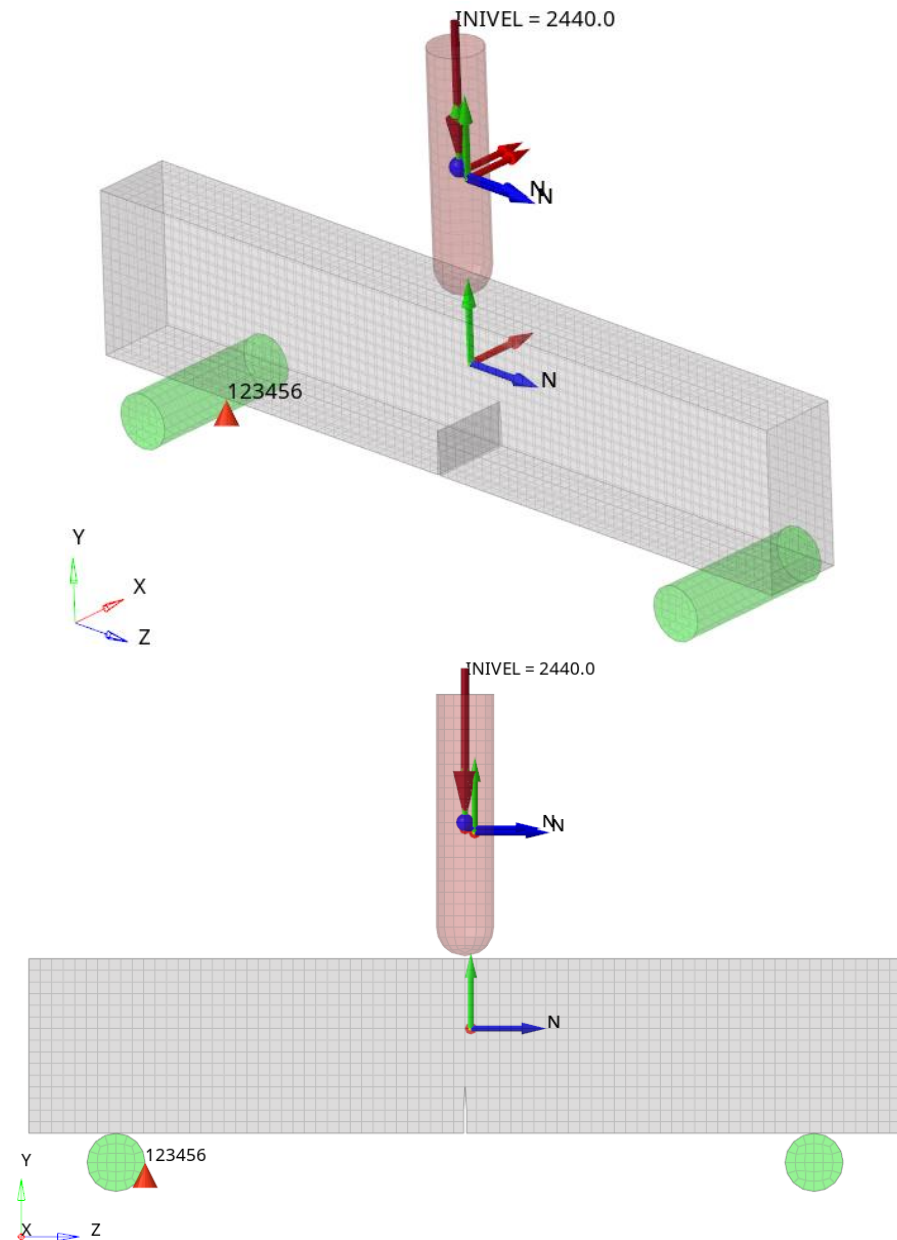
Model Parameters

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	3 sec

FEA Entities	Type
Analysis Type	Dynamic Explicit
Unit System	Tonne, mm, sec
Element Type	Solid Type 24
Material Type	M1_ELAST (impactor, anvil)
Material Type	M36_PLAS_TAB (specimen)
Contact Type	Type 25 – Multi type impacting

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Analysis Setup

INIVEL = 2440.0

Cross-section plane

Steel Impactor
- Solid elements
- Elastic material

Aluminum Specimen
- 2024-T4
- Solid elements
- Plastic tabulated material for various strain rates (data from paper)

Fixed BC

123456

Y

X   Z

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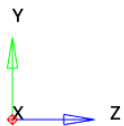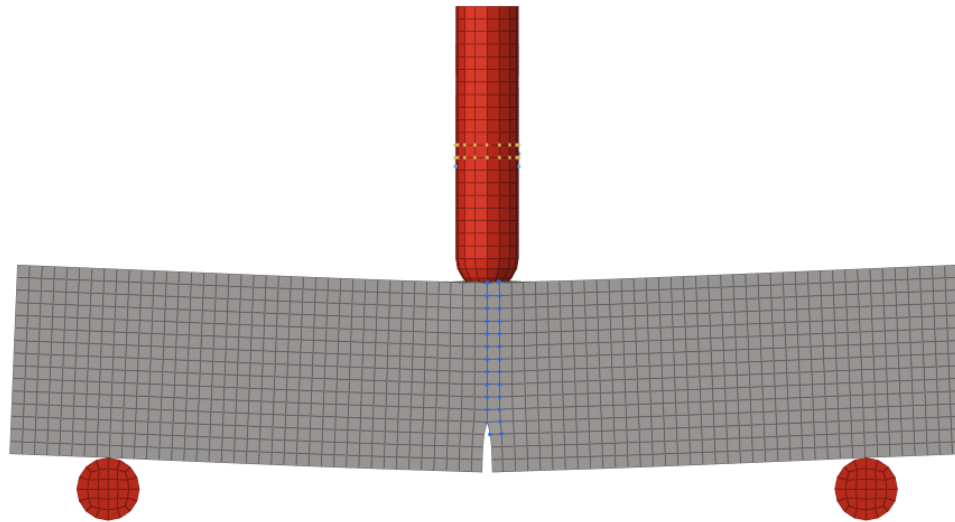Engineering
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Analysis Assumptions and Limitations

- According to paper, the crack was generated through fatigue loading of specimen. In this simulation the crack is modeled into the mesh directly based on the dimensions provided.

- The dimensions of the impactor are not provided in the paper and are thus assumed.

- This analysis does not evaluate crack propagation or failure. Further work would be needed to capture material failure.

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Analysis Results

1: 3ptbend_alum2024_mergednodes
Loadcase 1 : Time = 1.0000e-03 : Frame 101

Force Response

Impactor - Simulation
Test Data - AL2024-T4 - 2.44m/s
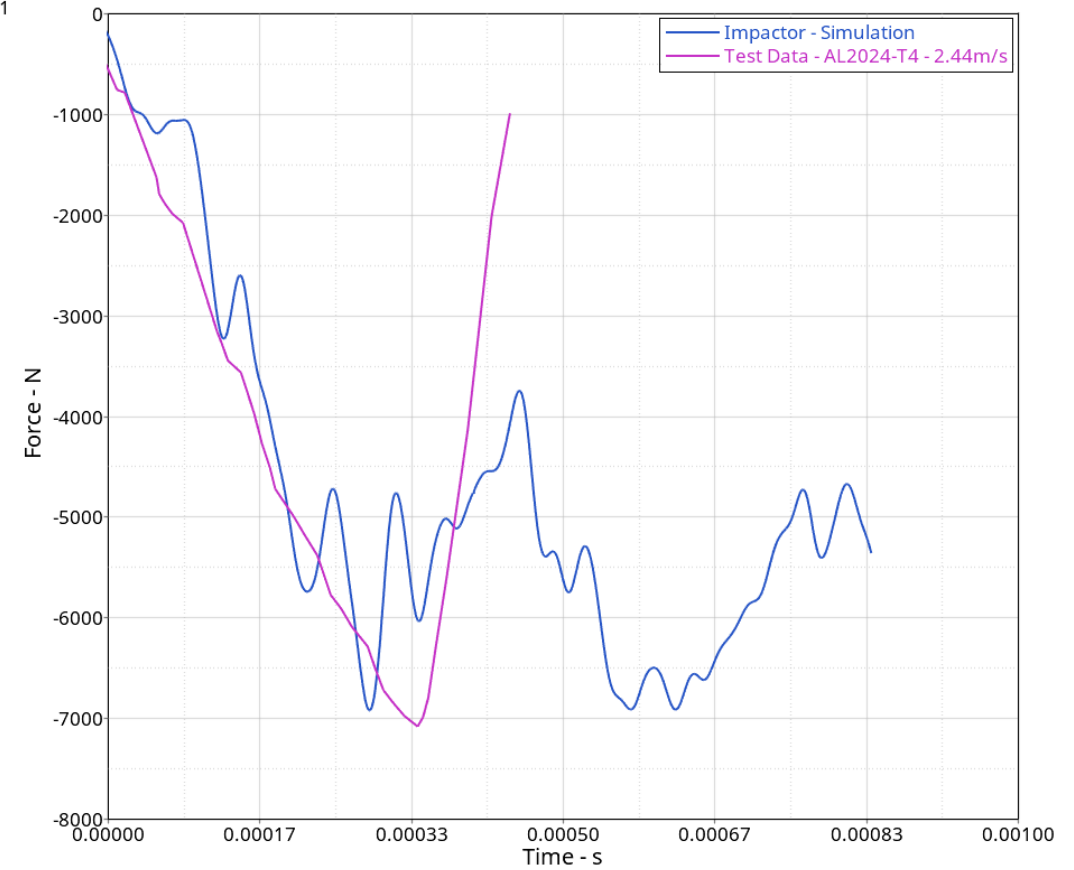
Conclusions

- Three-point bending analysis conducted using Altair Radioss based on the paper listed in slide 2.

- The simulation shows good correlation in force response measured by the impactor when compared to test data presented in the paper. Note that the simulation results have not been filtered as such information was not available in the paper.

- This model provides a good starting point for 3-pt bending FEA and can be further utilized to model damage and failure. The user can also explore the effect of different contacts, element formulations, mesh size and material models.

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