Squeeze Force during Solid Rivet Installation

For questions, please use contact form

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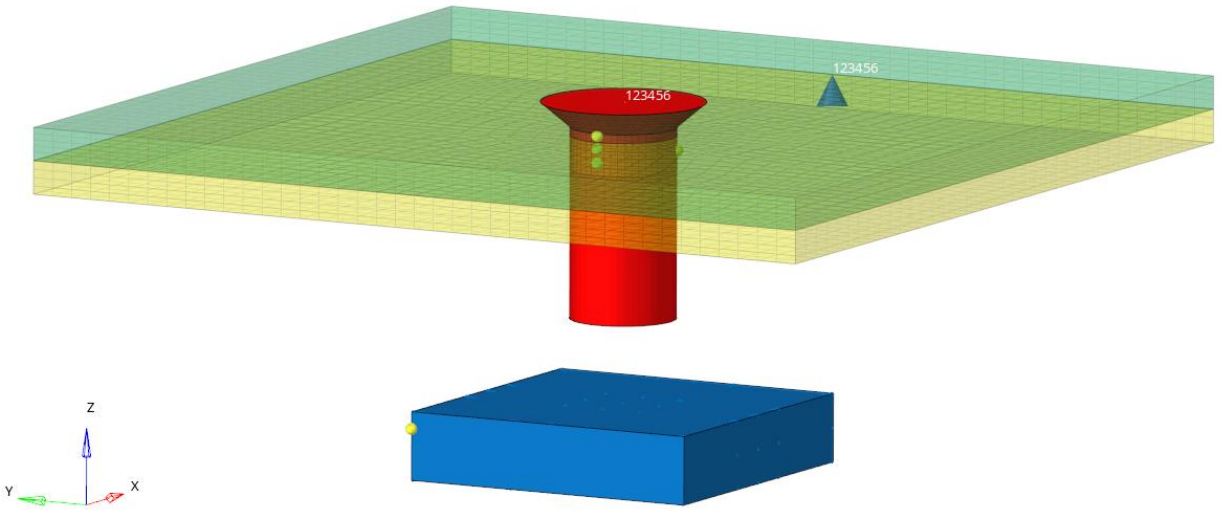
Model Description

- Simulation of installation of solid rivet is based on the experimental study documented in the following paper.
  - Rans, C., Straznicky, P. V., & Alderliesten, R. (2007). Riveting process induced residual stresses around solid rivets in mechanical joints. Journal of aircraft, 44(1), 323-329.

- Installation of NAS1097AD4 rivet in monolithic 2024-T3 aluminum sheets
  - Focus on rivet squeeze force
  - Countersink Rivet
  - Aluminum 2117-T4 rivet material



Model Parameters

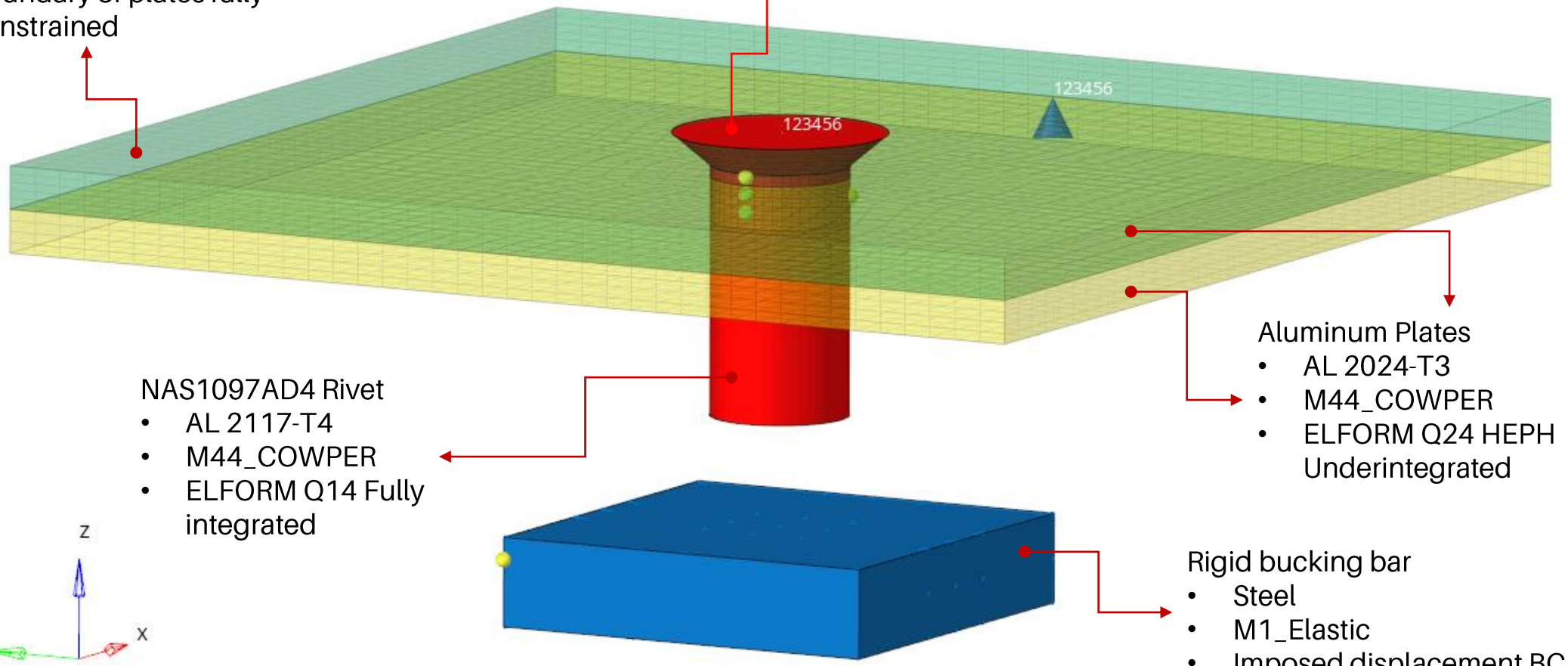
Entity	Type
Solver	Altair Radioss
Version	2022.1
Processors	2
Threads	2
CPU	Intel(R) Core(TM) i7-9750H CPU @ 2.60GHz
Total run time	1549.48 sec

FEA Entities	Type
Analysis Type	Dynamic Explicit
Unit System	Tonne, mm, sec
Element Type	P14_SOLID
Element Formulation	Q24, Q14
Material Type	M1_ELAST, M44_COWPER

Analysis Setup

Face of Rivet head fully constrained

Boundary of plates fully constrained



NAS1097AD4 Rivet
- AL 2117-T4
- M44_COWPER
- ELFORM Q14 Fully integrated

Aluminum Plates
- AL 2024-T3
- M44_COWPER
- ELFORM Q24 HEPH Underintegrated

Rigid bucking bar
- Steel
- M1_Elastic
- Imposed displacement BC

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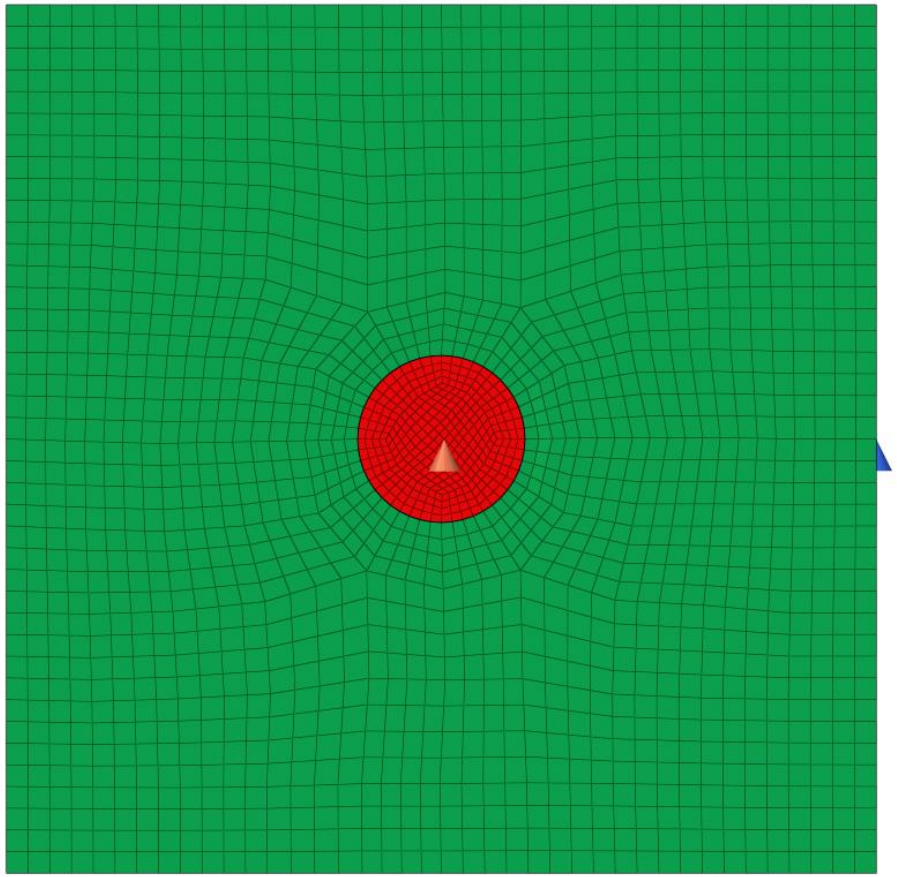
Mesh Quality

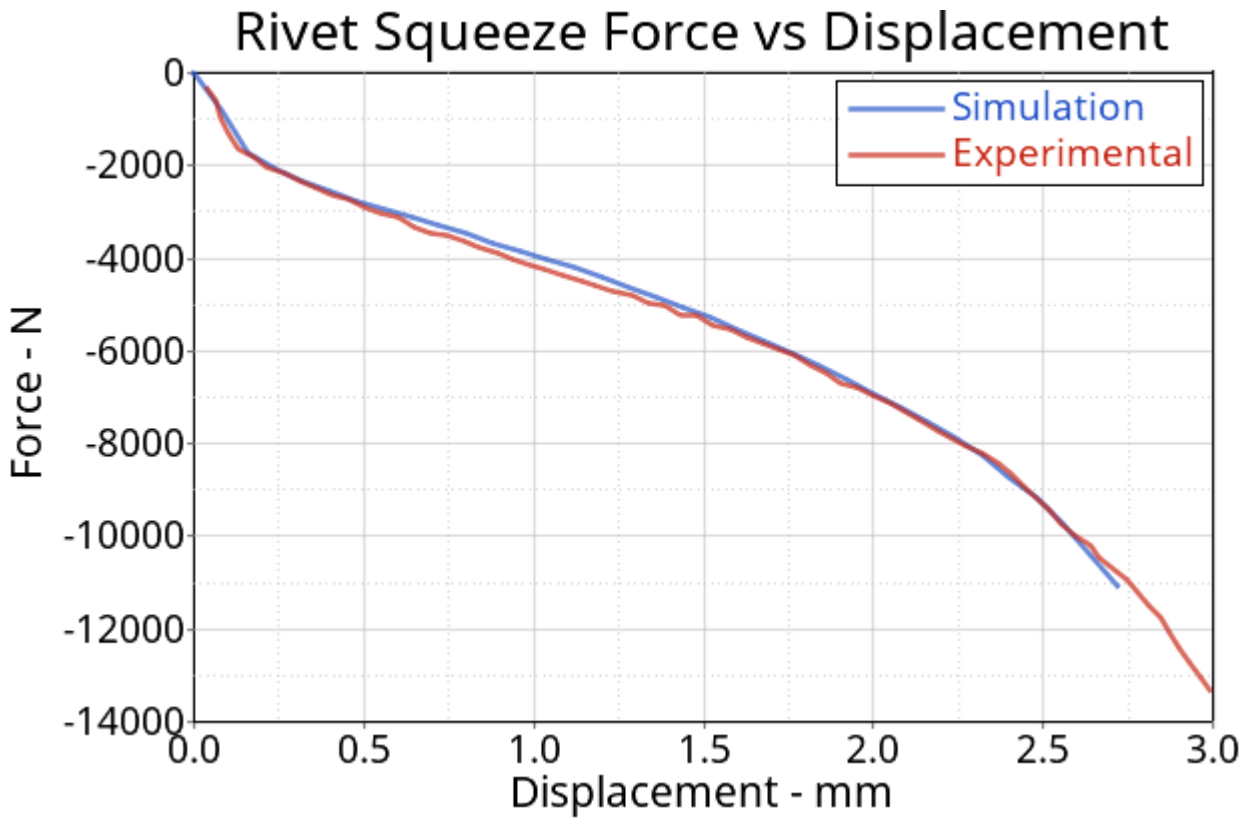
- 0.08 mm – min element length
- 0.69 – Jacobian
- 5 – max aspect ratio
- 30,456 solid elements



Assumptions

- Coarser mesh used compared to that in paper
  - Note: A quarter model could be used with finer mesh for further studies
- The clearance between uninstalled rivet diameter and the hole diameter of the plates was not specified. Thus a 0.01 mm clearance was used.
- A 0.01 mm clearance was also used for the rivet head and plates to help with contact instabilities.

Analysis Results



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Conclusions

- Simulation of rivet installation was conducted to study squeeze force.
- The simulation shows good correlation for the force displacement time history results when compared to the test data presented in the paper.
- The model runs very fast so it can be useful to study the effects of different material models and property parameters.
- The model mesh can be further refined to study detailed stress and strain distributions in the plate.
  - i.e. Mesh size and clearances based on your application