A Study of Warping of Non-circular Shafts in Torsion

Sanka Dasanayaka

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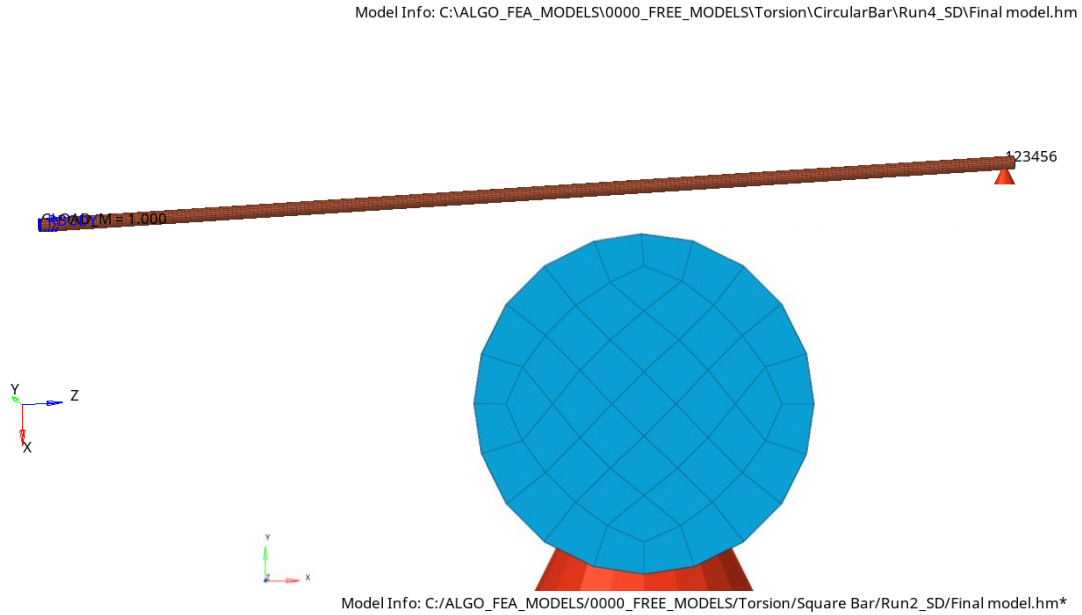
Model Description

- Warping and Torsion analysis based on experiments documented in the following paper:
  - Chattopadhyay, “A Study of Warping of Non-circular Shafts in Torsion.” Accessed: Sep. 06, 2022. [Online]. Available: https://peer.asee.org/19129.pdf
- As mentioned in the paper Aluminum 6061 has been used.



Model Description cont.

Circular Bar

- Diameter – 6.35 mm (0.25 in)
- Length – 457.2 mm (18 in)
- Length of the fixed end – 8 mm
- Distance from the end where the torque is applied to the cross section which the AOT is measured – 16 mm

Square Bar

- Length of a side – 6.35 mm (0.25 in)
- Length – 457.2 mm (18 in)
- Length of the fixed end – 8 mm
- Distance from the end where the torque is applied to the cross section which the AOT is measured – 16 mm

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Model Parameters

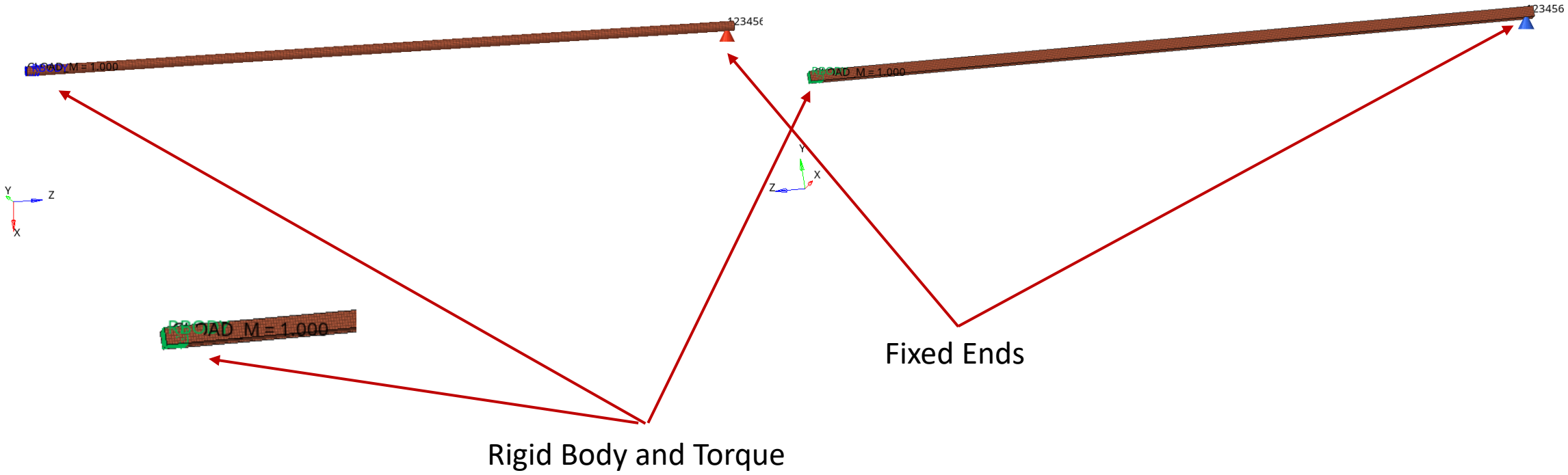
Entity	Type
Solver	Altair Radioss
Version	2021.2.1
Processors	2
Threads	2
CPU	Intel(R) Core(TM) i7-9750H CPU @ 2.60GHz
Total run time	10 sec

FEA Entities	Type
Analysis Type	Dynamic Explicit
Unit System	Kg, mm, ms
Element Type	HEXA8N (Bar)
Element Type	RBODY (Rigid Body)
Material Type	M1_ELAST (Bar)
Property Type	P14_SOLID (Bar)

Analysis Setup

Model Info: C:/ALGO_FEA_MODELS/0000_FREE_MODELS/Torsion/Square Bar/Run2_SD/Final model.hm*

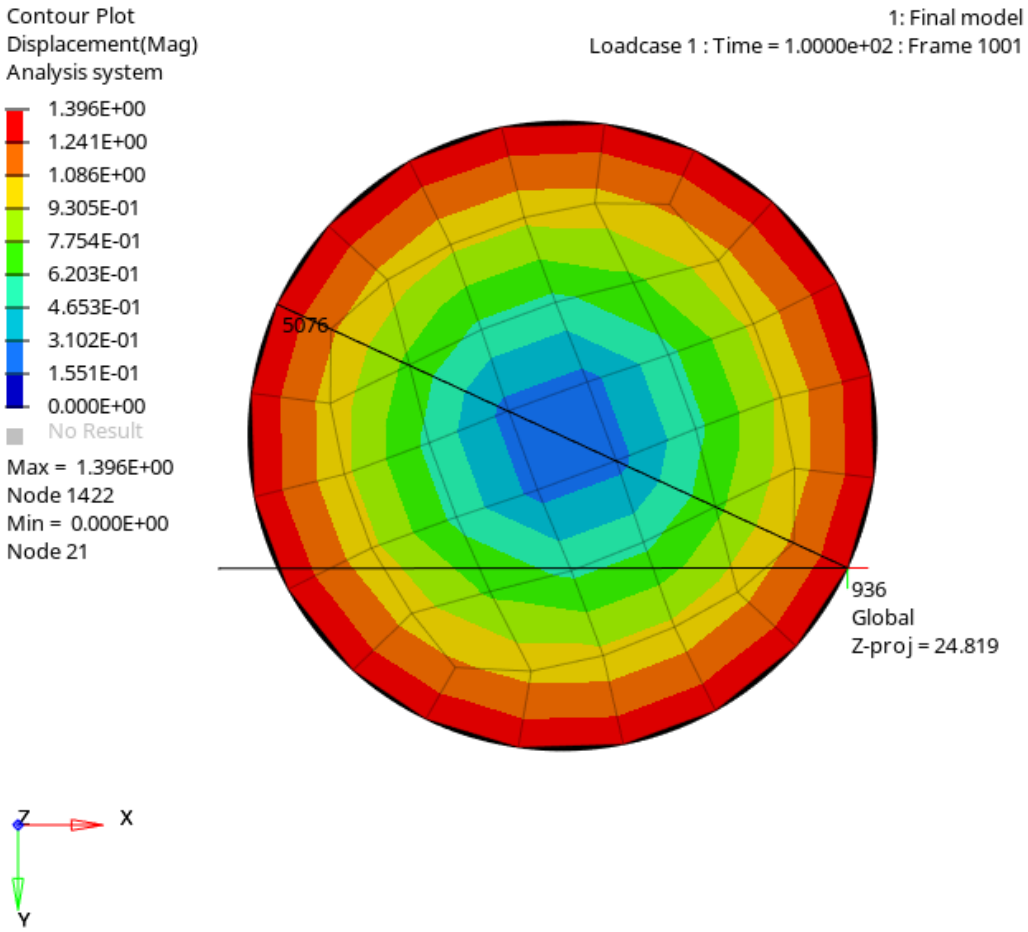
Model Info: C:\ALGO_FEA_MODELS\0000_FREE_MODELS\Torsion\CircularBar\Run4_SD\Final model.

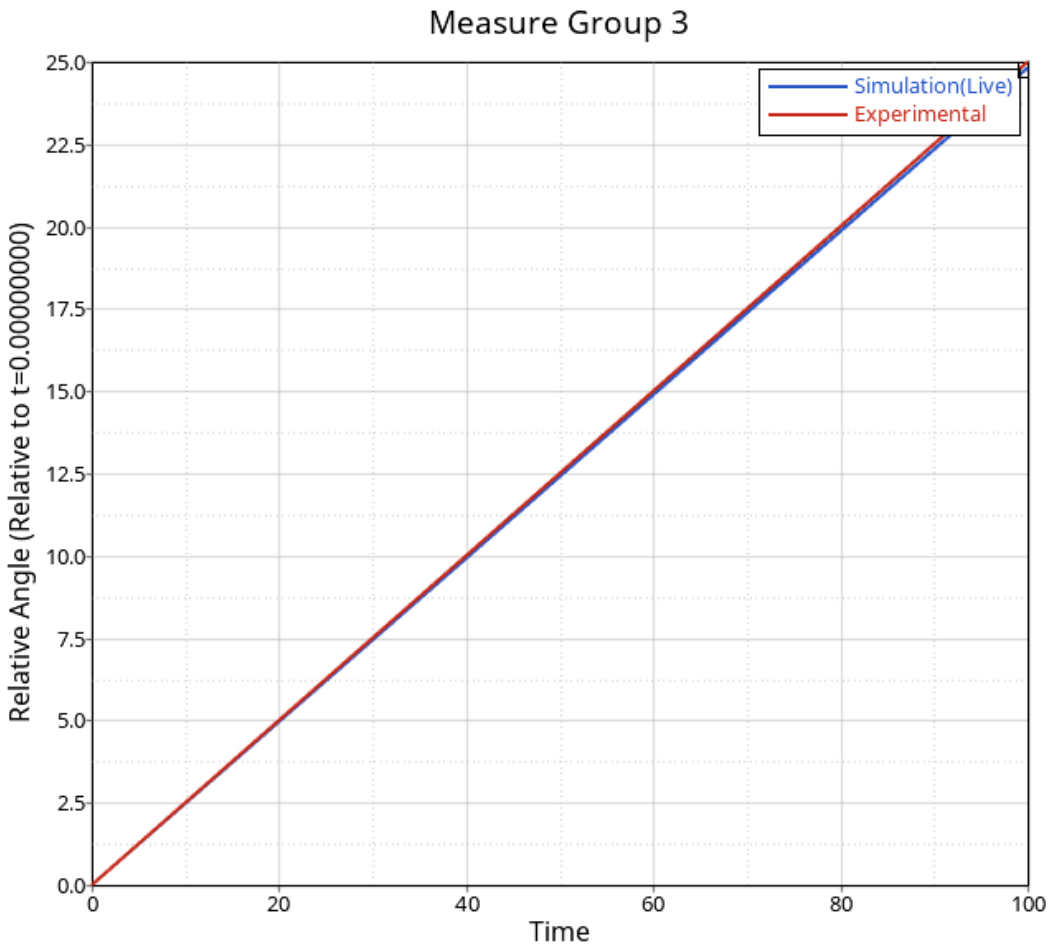


Analysis Assumptions and Limitations

- Young's modulus was calculated using the results given in the paper to get accurate results.
- Length of the fixed part of the bar is not provided in the paper and is thus assumed.

Analysis Results – Circular Bar





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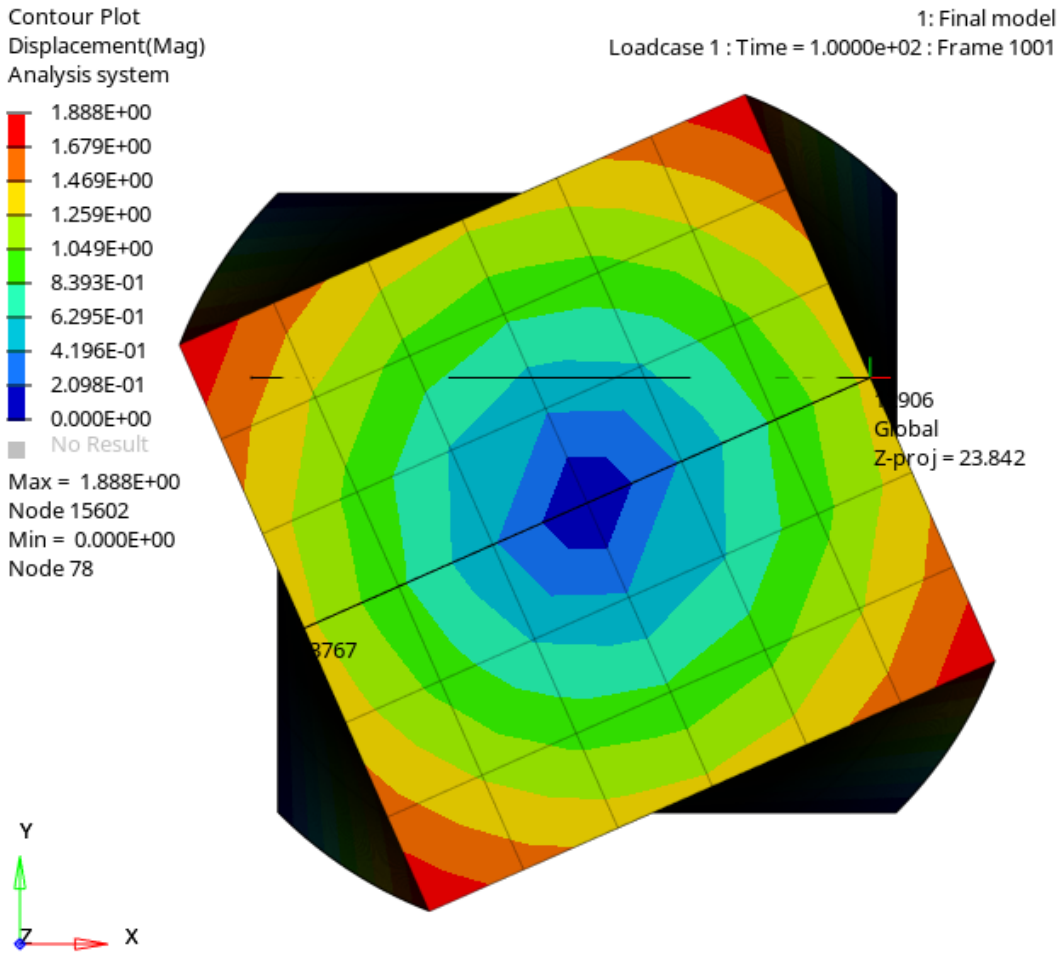
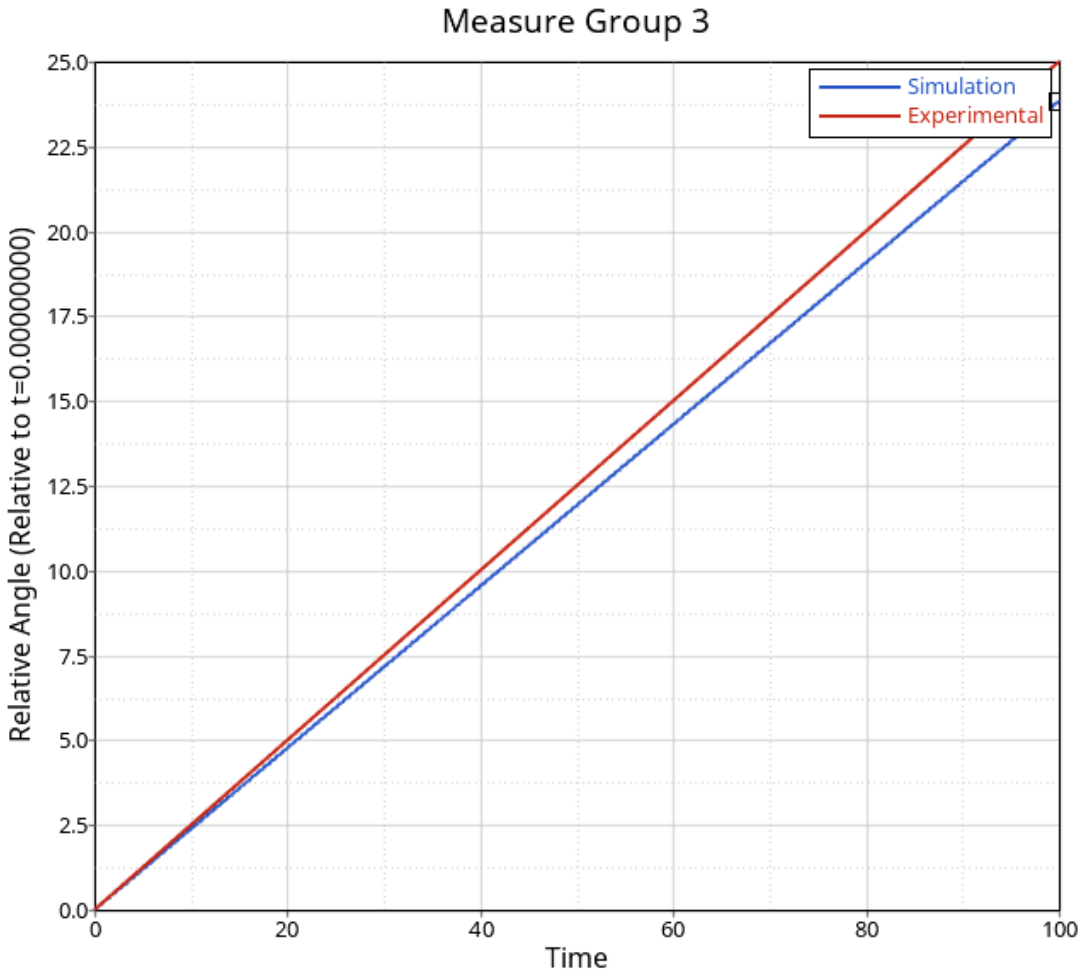
Analysis Results – Square Bar





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Conclusions

- Torsion and warping analysis conducted using Altair Radioss based on the paper listed in slide 2.
- Results of the simulation are correlate well to the test results given in the paper.
- This model provides a good start to torsion and warping analysis of circular and square bars.