Buckling of Thin-Walled Cylindrical Shells

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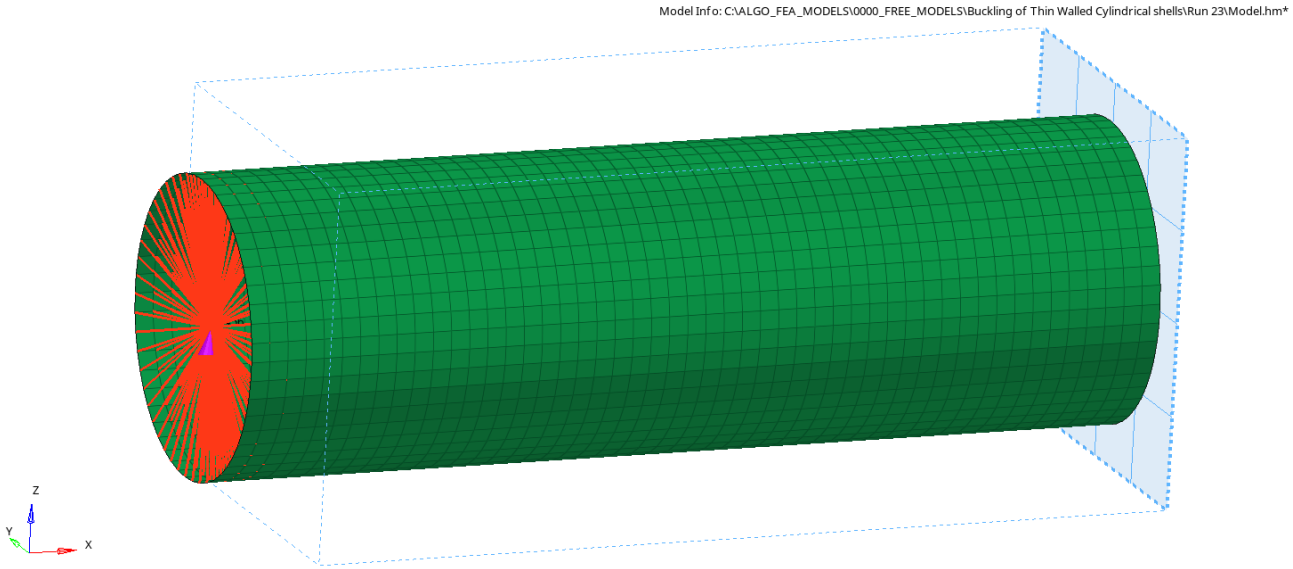
Model Description

- Buckling analysis of a Thin-Walled Cylindrical Shell is based on experiments documented in the following paper:
  - Walther, H.P. *et al.* (2007) *An experimental study of buckling of cylindrical shells subjected to static and dynamic axial impact., AN EXPERIMENTAL STUDY OF BUCKLING OF CYLINDRICAL SHELLS SUBJECTED TO STATIC AND DYNAMIC AXIAL IMPACT. (Conference) | OSTI.GOV.* Available at: https://www.osti.gov/biblio/1147537 (Accessed: October 19, 2022).

- **Out of all the cases mentioned in the paper, A cylindrical shell of Aluminum AMc under static loading was chosen.**

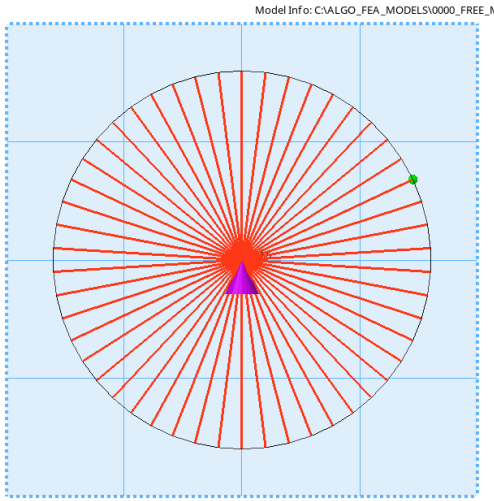


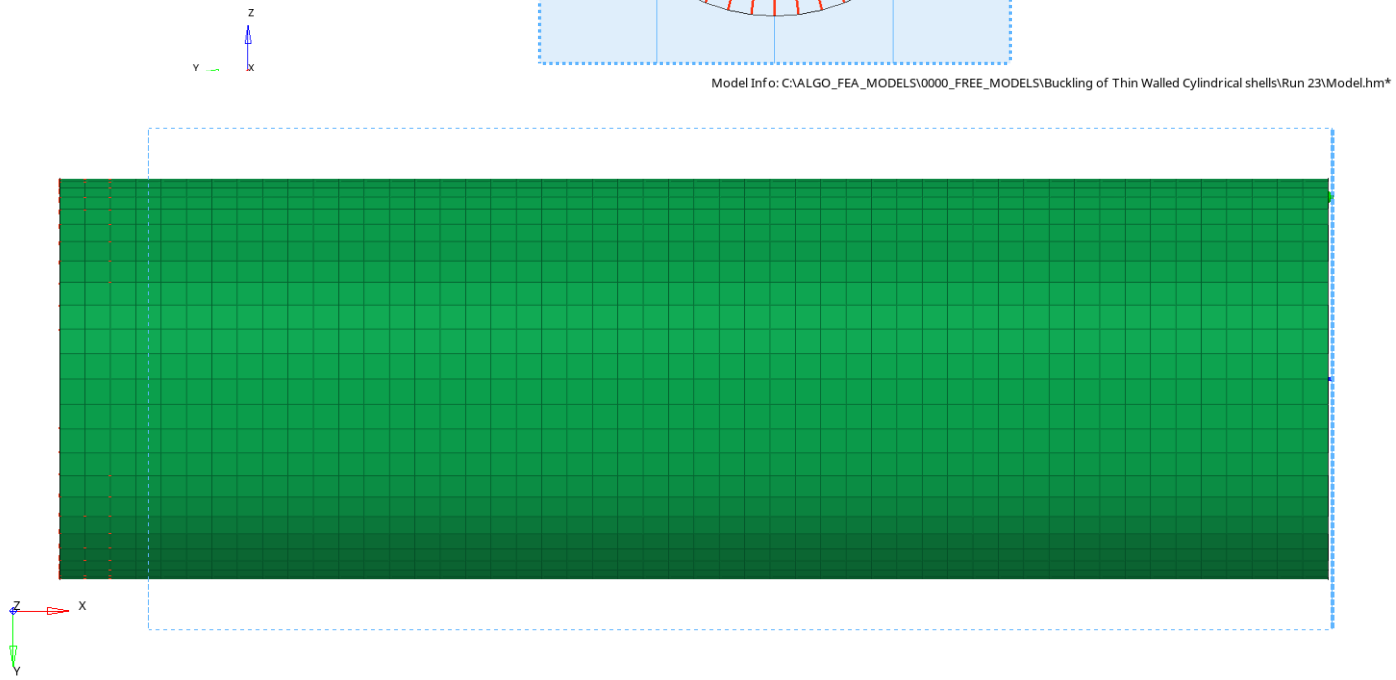
Model Description cont

Dimensions and Material

- Diameter – 100 mm
- Length – 300 mm
- Thickness – 5 mm

- The stress-strain curve of the material v digitized from the paper and used for tl analysis





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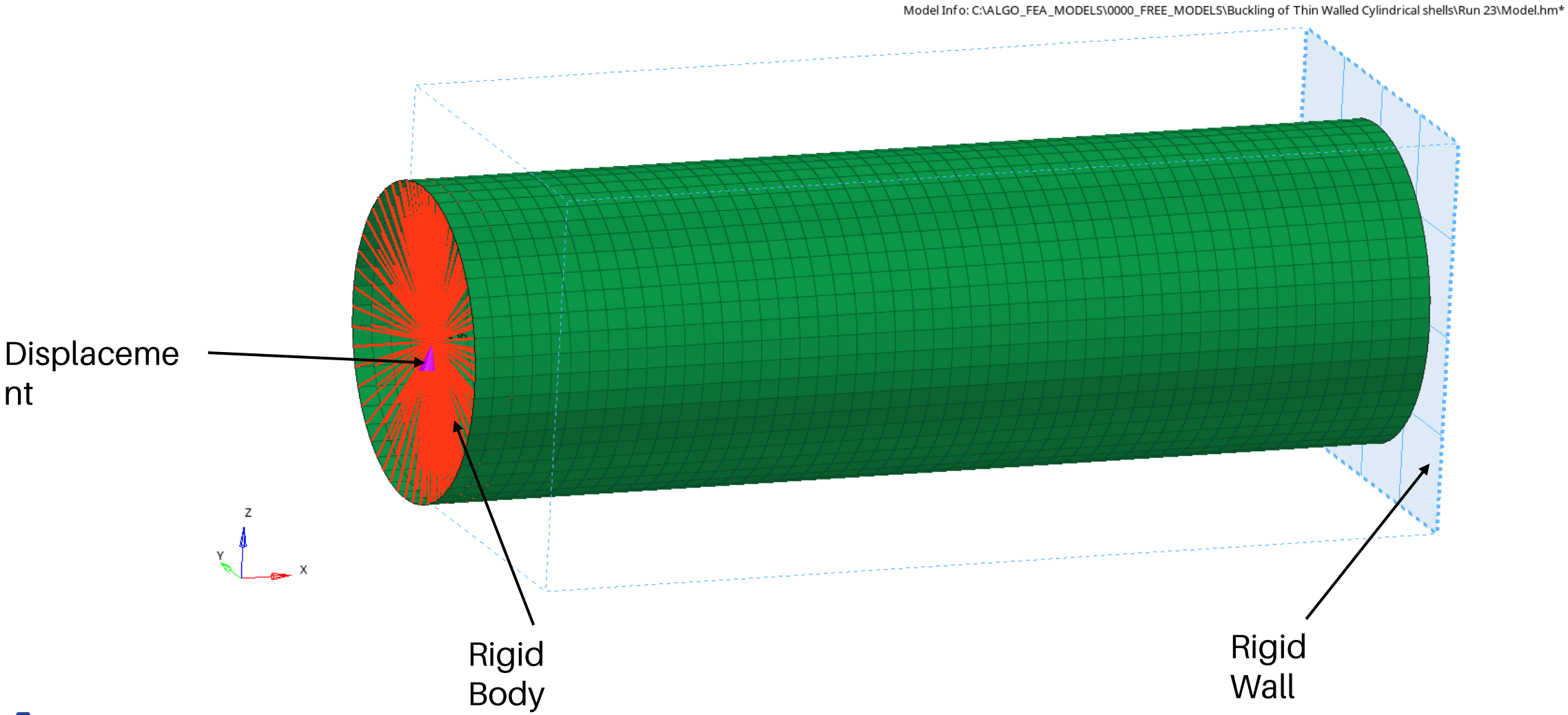
Model Parameters

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	1200 sec

FEA Entities	Type
Analysis Type	Dynamic Explicit
Unit System	Kg, mm, ms
Element Type	SHELL4N (Cylinder)
Element Type	RBODY (Rigid Body)
Material Type	M36_PLAS_TAB (Cylinder)
Property Type	P1_SHELL (Cylinder)

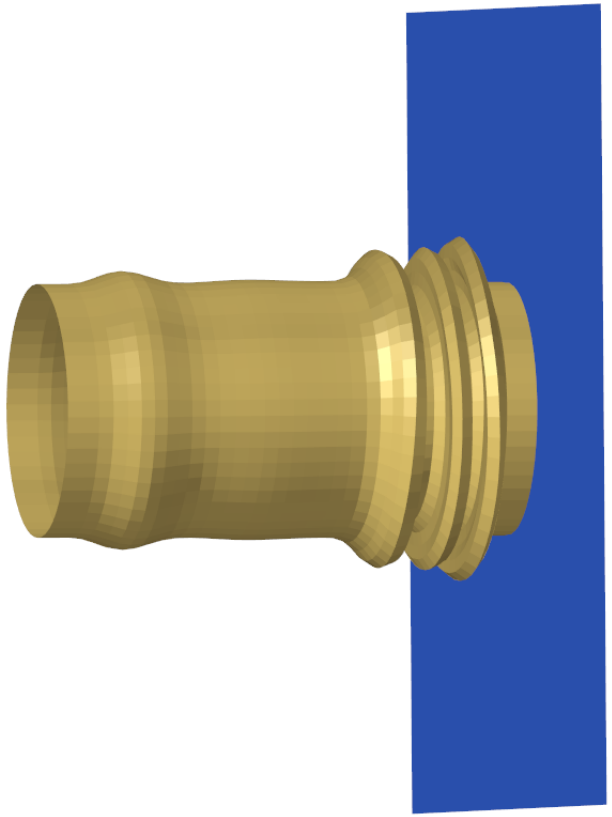
Analysis Setup

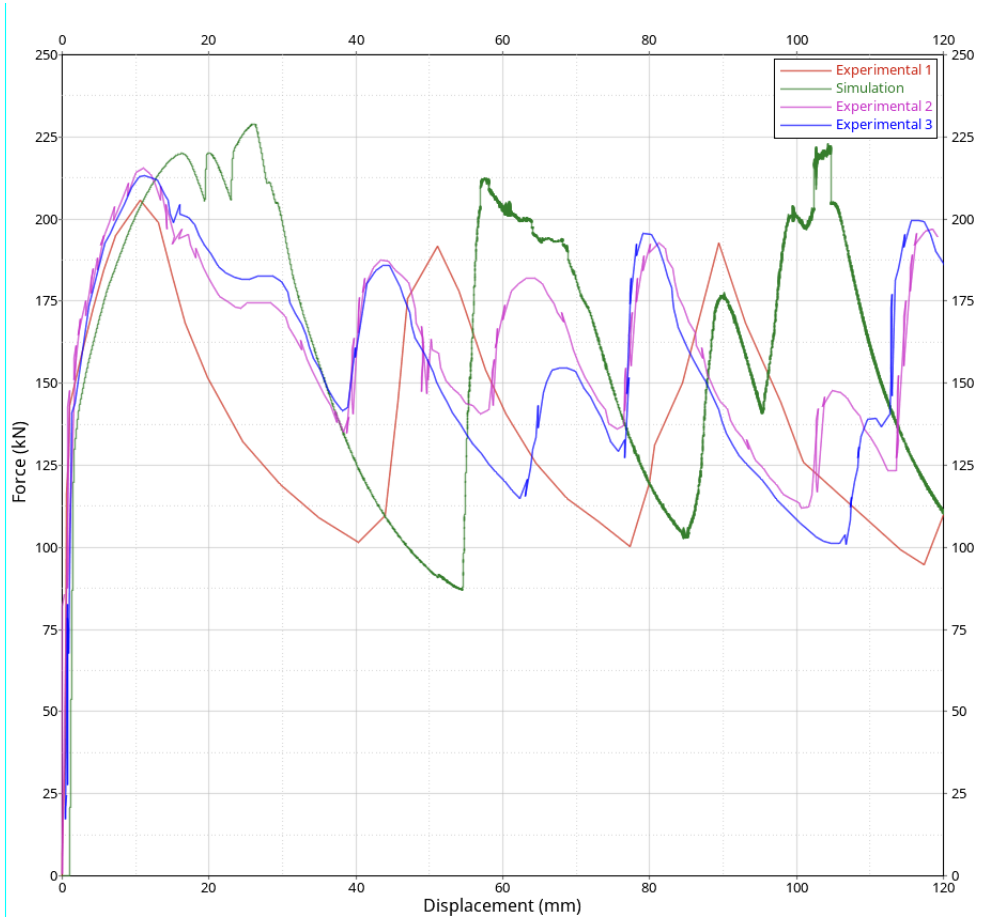


Analysis Assumptions and Limitations

- Test setup is simplified to a cylinder with shell elements and a rigid wall to reduce the run time and complexity.
- Static loading velocity is increased to 0.1 m/s to reduce the run time.
- The friction coefficient between the rigid wall and the cylinder is assumed as 0.9.
- Density and the Poison’s ratio are not provided and thus assumed.
- Fiction coefficient between cylindrical shells itself is not provided in the paper and is thus assumed as 0.1.

Analysis Results





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Conclusions

- Buckling of thin-walled cylindrical shells conducted using Altair Radioss based on the paper listed in slide 2.
- Results of the simulation:
  - The load magnitudes compare well with test data
  - Load oscillation cycles vary, and this can be attributed to the simplifications and assumptions of the FEA model
    - Note that there is a difference even between the three experiments
- This model provides a good start to analysis of buckling of thin-walled cylindrical shells.