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RamSeries - Validation Case 11

Pinched clamped cylinder

RamSeries

Version
15.1.0

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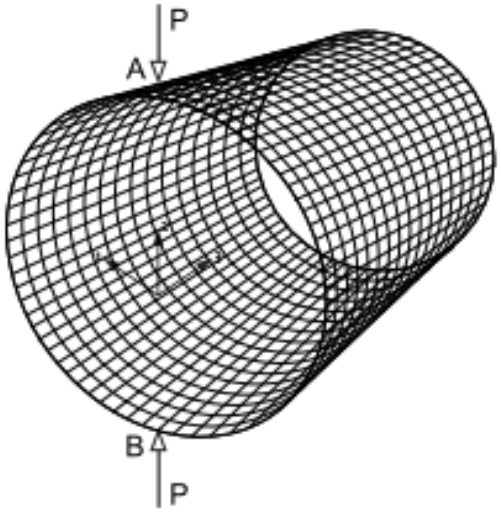
1 Validation Case 11 - Pinched clamped cylinder

Model Description

This test case is based on the Non-Linear test "Pinched clamped cylinder", described in Ref. [1].

The cylinder shell is clamped at one end and loaded by two opposite forces P at the other end, as shown in the following image:



With:

R = 1.016 m

L = 3·R m

h = 0.03 m

Due to the symmetry, only a quarter of the cylinder is analyzed.

The material is assumed to be linear elastic:

E = 2.0685e10^{7} Pa

μ = 0.3

Results

For the sake of validation, a simulation was run using the properties described in the previous chapter, and with the following load and problem conditions:

Mesh:

Two linear structured triangular meshes of 16x16 and 32x32 divisions (1024 and 4096 elements, respectively) are used.

Displacements results:

- Linear solution:

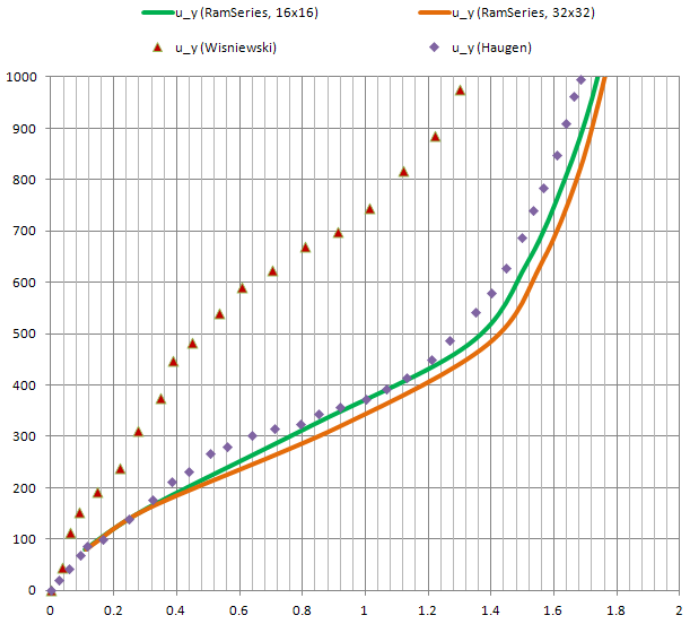
The non-zero displacements at point A obtained by the linear analysis for P = 1 N in RamSeries and the error with respect to the reference solution, are shown next:

	u_y (m)	u_z(m)
Reference (16x16)	-7.9444E-04	5.4283E-05
Ramseries (16x16)	-7.9863E-04	5.3070E-05
Error (%)	0.53	2.23
Reference (32x32)	-8.2379E-04	5.3697E-05
Ramseries (32x32)	-8.1173E-04	5.3002E-05
Error (%)	1.46	1.29

- Nonlinear solution:

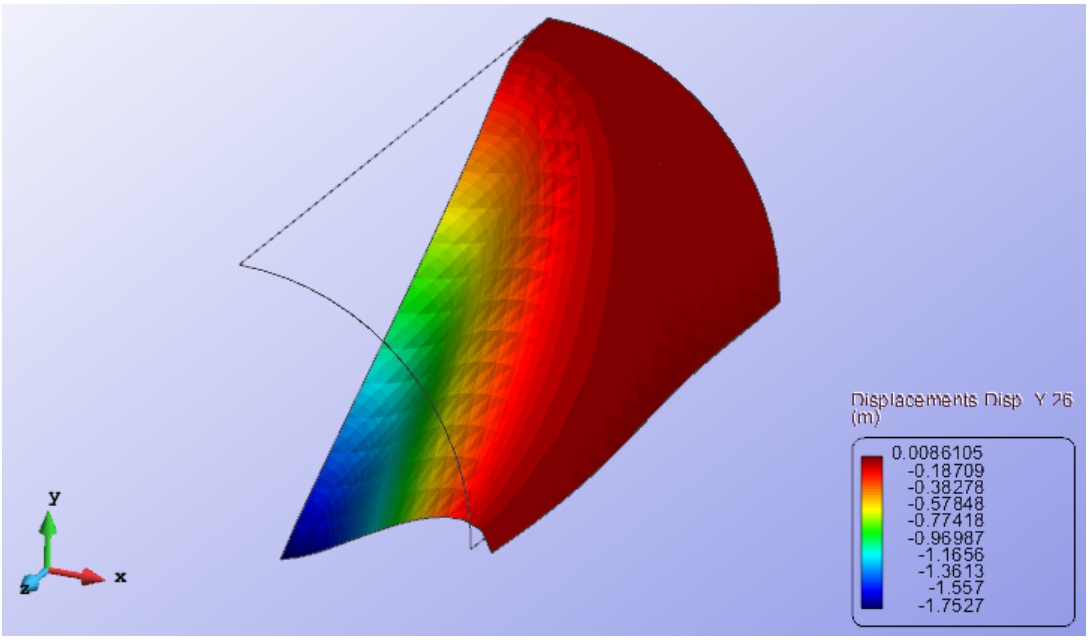
The nonlinear solution was obtained for a load of P_{ref} = 1000 N, with ΔP = 80 N for the 32x32 mesh, and ΔP = 40 N for the 16x16 mesh (20 and 40 increments respectively).

The next graphs show, first, the results obtained with RamSeries -both 16x16 and 32x32 meshes- compared with solutions obtained with Green strain formulation (Wisniewski, Ref. [1]), and with co-rotated formulation (Haugen, Ref. [2]). This last formulation is the one used in RamSeries.



Non-linear solutions (RamSeries VS References)

The next image shows the deformation obtained in RamSeries:



References

[1] K. Wisniewski. Finite Rotation Shells: Basic Equations and Finite Elements for Reissner Kinematics. Springer (2010).

[2] Bjorn Haugen. Buckling and Stability Problems for Thin Shell Structures Using High Performance Finite Elements. University of Colorado (1994).

Validation Summary

CompassFEM version	15.1.0
Tdyn solver version	15.1.0
RamSeries solver version	15.1.0
Benchmark status	Successfull
Last validation date	27/11/2018