

RamSeries - Validation Case 13

Elliptic plate under tensile (NAFEMS LE 1)



RamSeries

Version
15.1.0

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1 Validation Case 13 - NAFEMS LE1

Model Description

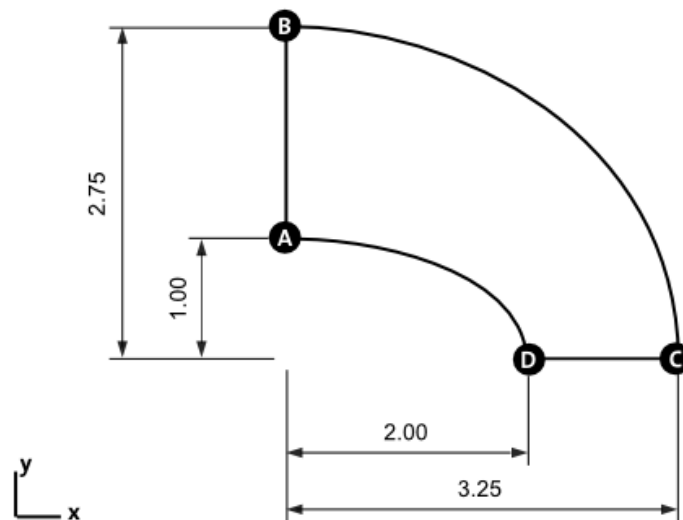
This test case is based on the NAFEMS LE1 "Elliptic plate under tensile", described in Ref. [1].

An elliptic plate with thickness "t" is subjected to a uniform outward pressure "P" on the outer elliptic cylindrical face, and unloaded at the inner face. The plate is symmetric about the YZ and XZ planes.

The tangential edge stress at corner D (stress in Y direction) will be determined.

Dimensions:

Thickness: $t=0.1$ m



Geometrical description (dimensions in [m])

Load value:

$P=10$ MPa

Material data:

The material is assumed to be lineal elastic.

$E = 2.1e5$ MPa

$\mu = 0.3$

Mass density = $7.85e-6$ kg/mm³

Tensile Yield Strength = 207.0 MPa

Results

For the sake of validation, various simulation were run using the properties described in the previous chapter, with different meshes.

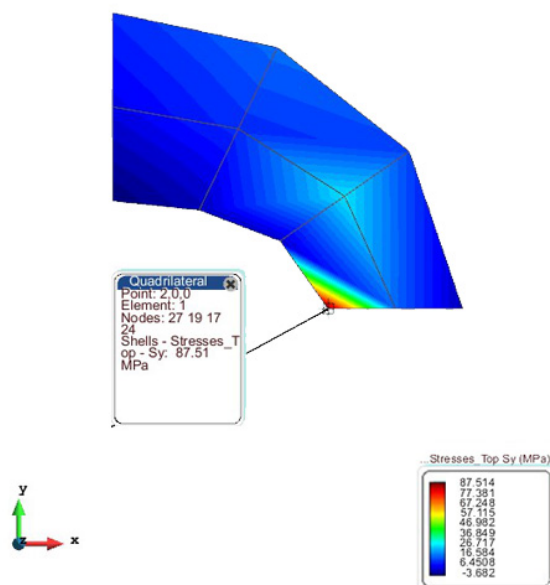
The following summary table shows the difference between the tangential edge stress at corner D and the reference case (NAFEMS EL1, Reference [1]):

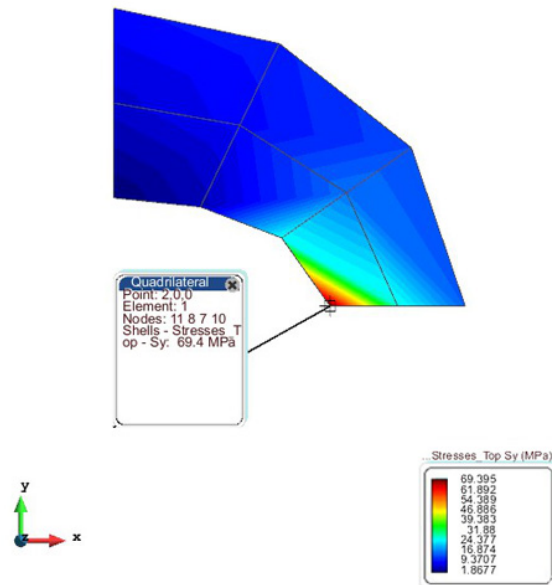
Sy NAFEMS EL1 = 92.7 MPa

	RamSeries Sy (MPa)	Diff. (%)
Coarse Linear Quad	69.395	25.14
Coarse Parab. Quad	87.514	5.59
Fine Linear Quad	85.43	7.84
Fine Parab. Quad	89.97	2.94
Coarse Linear Triang.	42.13	54.55
Coarse Parab. Triang.	83.48	9.95
Fine Linear Triang.	61.18	34.00
Fine Parab. Triang.	93.4	0.76

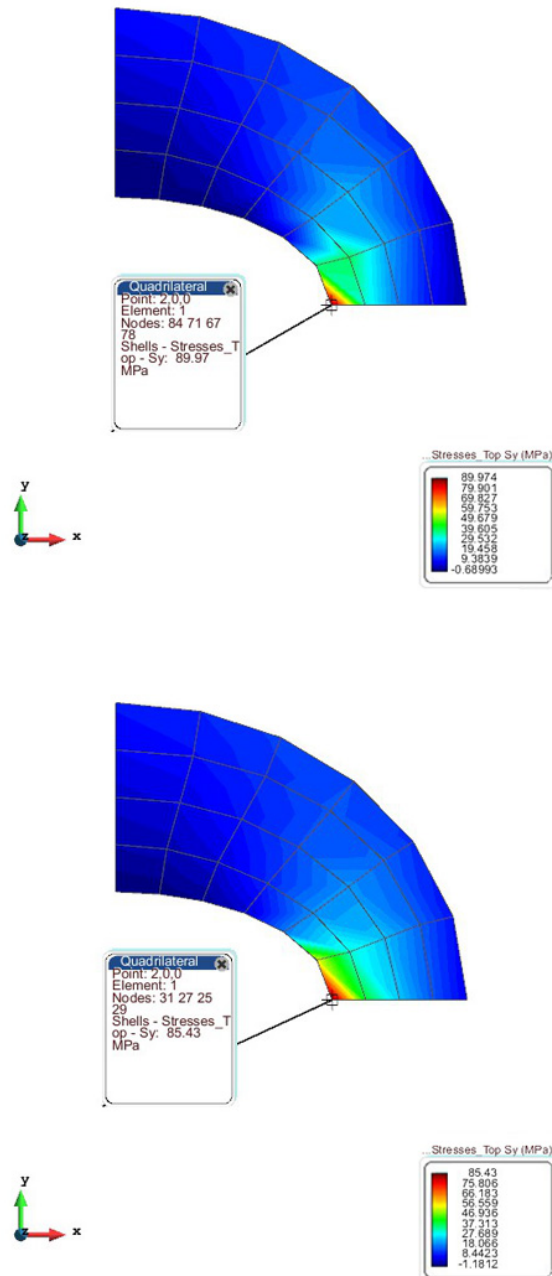
Results for the different meshes:

- Coarse Linear (right, 12 nodes/6 elems) and Parabolic (left, 29 nodes/6 elems) quads:

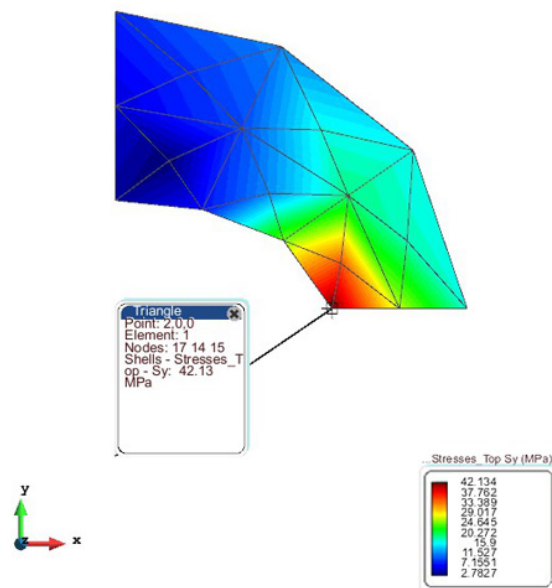
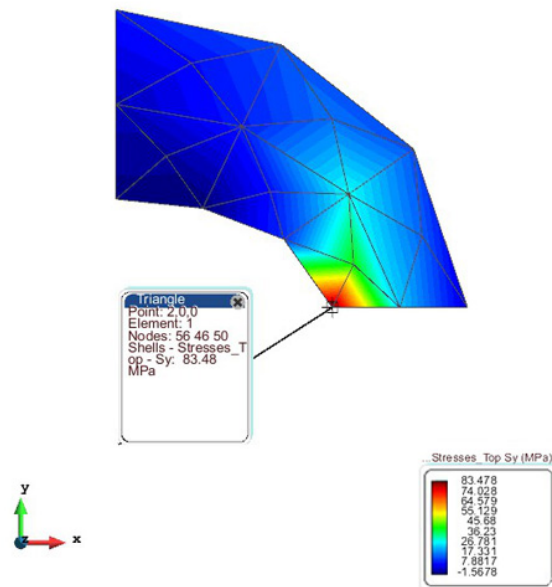




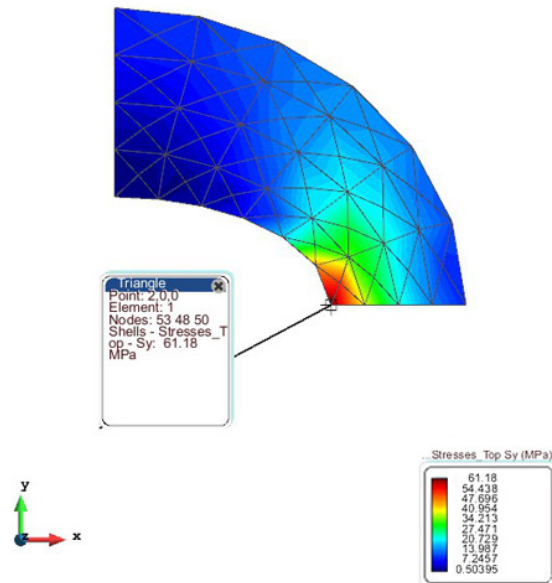
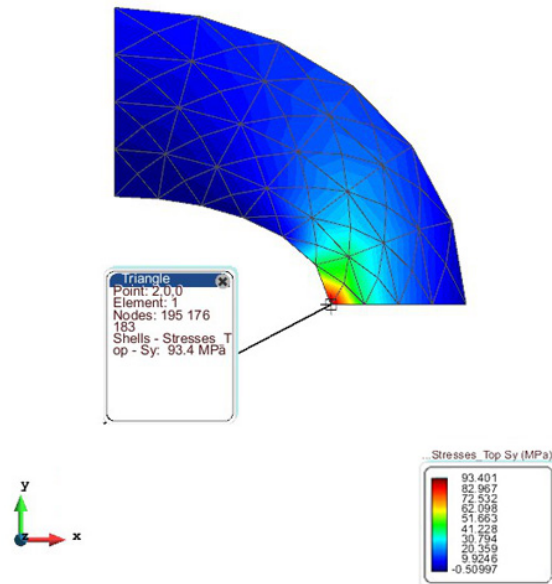
- Fine Linear (right, 35 nodes/24 elems) and Parabolic (left, 92 nodes/24 elems) quads:



- Coarse Linear (right, 18 nodes/24 elems) and Parabolic (left, 59 nodes/24 elems) triangles:



- Fine Linear (right, 59 nodes/96 elems) and Parabolic (left, 213 nodes/96 elems) triangles:



The following table shows the results for Nastran, coming from Reference [2]:

Sy NAFEMS EL1 = 92.7 MPa

	NX Nastran (MPa)	Diff. (%)
Coarse Linear Quad	62.10	33.01
Coarse Parab. Quad	84.00	9.39
Fine Linear Quad	79.60	14.13
Fine Parab. Quad	88.70	4.31
Coarse Linear Triang.	52.90	42.93
Coarse Parab. Triang.	76.80	17.15
Fine Linear Triang.	70.90	23.52
Fine Parab. Triang.	93.60	0.97

References

- [1] NAFEMS Finite Element Methods & Standards. The Standard NAFEMS Benchmarks, Test No. LE1. Glasgow: NAFEMS, Rev. 3, 1990.
- [2] NX Nastran Verification Manual. UGSCorp. 2007.

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