BML-4: BEAM SUBJECTED TO BENDING

Summary

Issue 1 (Publication date: 10/04/2013)

Model: beam subjected to bending
Reference:

- E. Oñate (1995), *Cálculo de estructuras por el método de los elementos finitos, análisis estático lineal, Ed. CIMNE, 2nd edition, Barcelona. Pag. 316.*

Element type(s) tested:

Description	Designation	COMET models	See in DATA INPUT MANUAL V.5.0
Solid Tetrahedral 3D element – 4 nodes	L-TETRA4-R *Open integr. rule and 1 node (reduced integr.) are used	BML-4-beam-with concentrated-load-L-tetra4R.gid	Sect. 4, pp. 42 and 61
Solid Parabolic Tetrahedral 3D element – 10 nodes	Q-TETRA10	This elem. Is not included at this issue	Sect. 4, pp. 42, 61
Solid Linear Brick 3D element – 8 nodes	L-HEXA8* *Open integr. rule and 8 nodes are used	BML-4-beam-with concentrated-load-L-hexa4.gid	Sect. 4, pp. 43 and 61
Solid Parabolic Brick 3D element – 20 nodes	Q-HEXA20	This elem. Is not included at this issue	Sect. 4, pp. 43, 61
Solid Parabolic Brick 3D element – 27 nodes	Q-HEXA27	This elem. Is not included at this issue	Sect. 4, pp. 43, 61

Problem definition

A beam is subjected to bending load (F_0) on one end and all displacements are restricted on the other, like is shown in Figure 11.

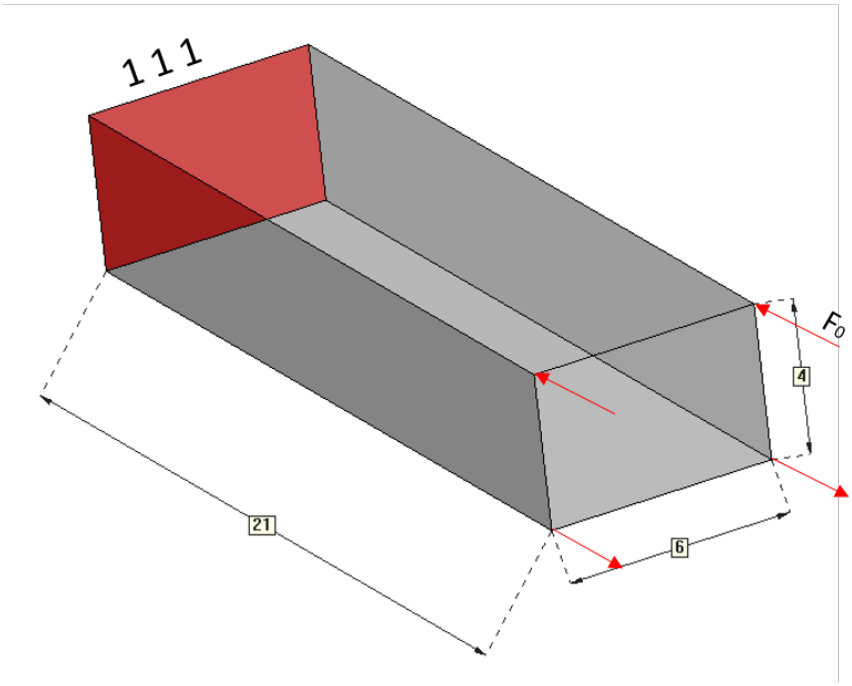

Figure 1: Beam subjected to bending geometry and applied conditions and loads

Data related to the test case can be shown in Table 2 2

Material Properties	Geometric properties	Loading
E = 2.0e+11 Pa v = 0.33	l = 0,21m w = 0,06m h = 0,04m	F_0 = 40 000N

Table 2 : Anaysis data

Analysis

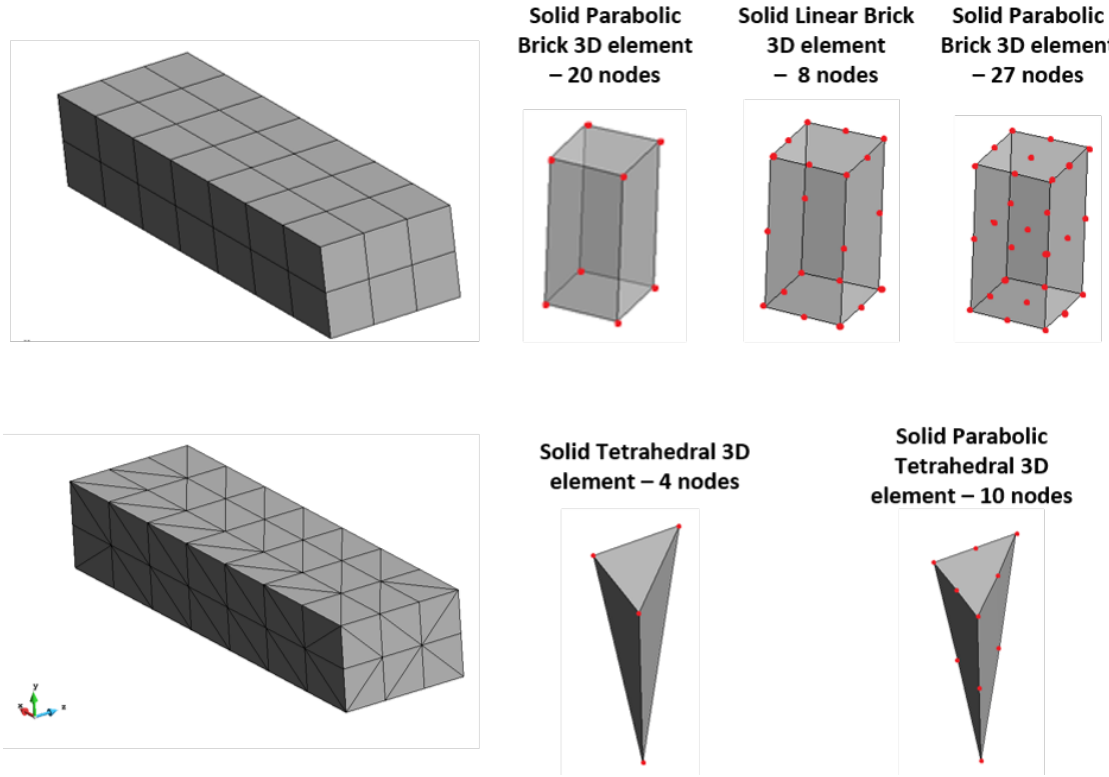

Figure 2 : Beam mesh and element type(s) tested.

Results

With solid Tetrahedral (374 node and 3024 tetrahedral elements)

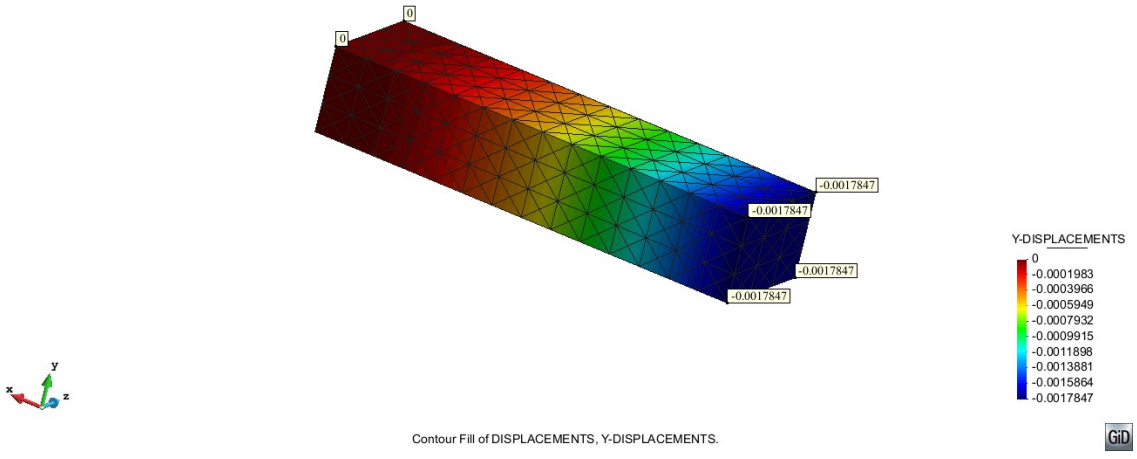

Figure 3: Deflection of a beam, solid Tetraedral elements.

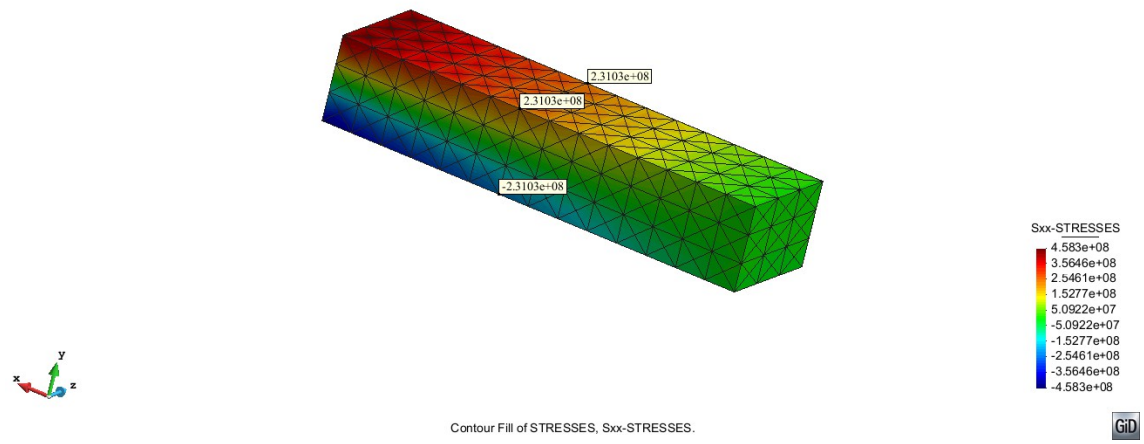

Figure 4: Normal stress of a beam, with solid Tetraedral elements .

With solid linear Brick 3D (188node and 126 solid linear Brick)

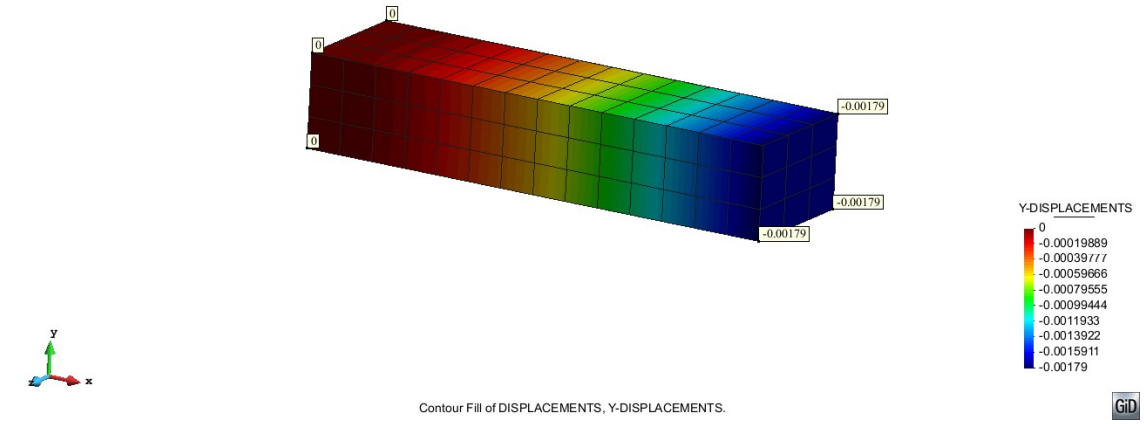

Figure 5 : Deflection of the beam, solid linear Brick 3D.

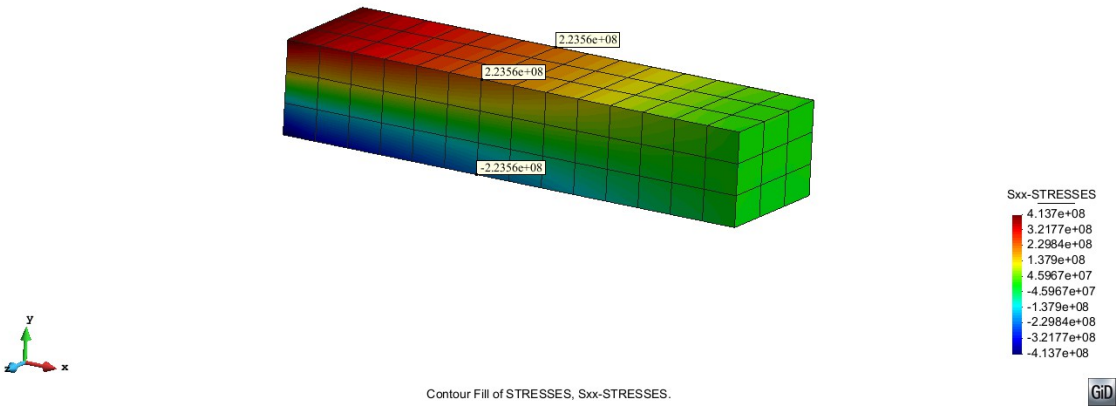

Figure 6: Normal stress of a beam, with solid linear Brick 3D.

Results summary

Dimension	Element type	Theorical result	COMET result	Relative Error
3D	Solid Tetrahedral 3D element	Deflection-0.001929m	Deflection-0.00187m	=3,05%
	Solid Linear Brick 3D element	Deflection-0.001929m	Deflection-0.00187m	=2,90%