

SSLP301 – Trapezoidal plate under actual weight

Summary:

The objective of this CAS-test is to validate the features making it possible to define the actual weight in an analysis in plane constraints.

The loading is applied with the keyword `GRAVITY` (modeling A) and `FORCE_INTERNE` (modeling B).

1 Problem of reference

1.1 Geometry

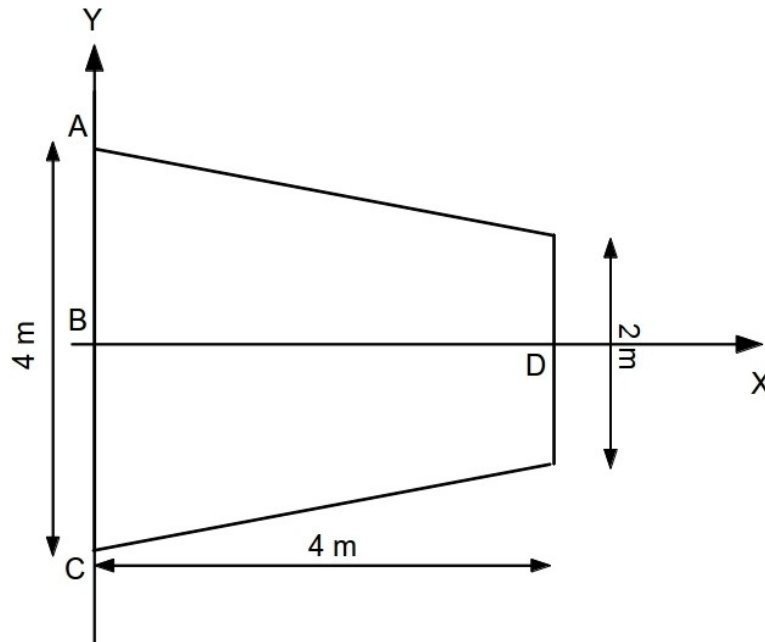


Figure 1.1 Geometry of the problem and system of loading

Thickness: $h = 0.1 \text{ m}$

1.2 Properties of material

Young modulus	$E = 2.1 \times 10^{11} \text{ Pa}$
Poisson's ratio	$\nu = 0.3$
Density	$\rho = 7000.0 \text{ kg.m}^{-3}$

1.3 Boundary conditions and loadings

Imposed displacement:

Embedding on the edge AC	$DX = 0, DY = 0$
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Imposed loading:

Actual weight on all the plate (according to the direction $-Y$)	$g = 9.81 \text{ m.s}^{-2}$
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2 Reference solution

2.1 Method of calculating used for the reference solution

The calculation of the solution is detailed in the reference given in 2.4 .

2.2 Results of reference

Displacement u_y^D point D is equal to:

$$u_y^D = 12 \times 10^{-6} \text{ m}$$

The value of the shear stress at the point B is:

$$\sigma_{xy}^B = -19.9 \times 10^4 \text{ Pa}$$

2.3 Uncertainty on the solution

Analytical solution.

2.4 Bibliographical references

A. Kamoulakos – G. Davis – D. Hitchings. *Benchmark tests for various finite element assemblies*. NAFEMS, April 1985.

3 Modeling A

3.1 Characteristics of modeling A

Modeling C_PLAN.

Actual weight imposed by the keyword GRAVITY in AFFE_CHAR_MECA.

3.2 Characteristics of the grid

Many nodes: 1681

Many meshes and types: 400 TRIA6

3.3 Sizes tested and results

Size	Component	Localization	Value of reference	Type of reference	Tolerance (%)
DEPL	DY	$D (N1249)$	$-1.2 \times 10^{-5} m$	'ANALYTICAL'	2.1
SIGM_ELNO	SIXY	$B (N11)$	$-1.99 \times 10^5 Pa$	'ANALYTICAL'	0.1

4 Modeling B

4.1 Characteristics of modeling B

Modeling C_PLAN.

Actual weight imposed by the keyword FORCE_INTERNE in AFFE_CHAR_MECA .

4.2 Characteristics of the grid

Many nodes: 1681

Many meshes and types: 400 TRIA6

4.3 Sizes tested and results

Size	Component	Localization	Value of reference	Type of reference	Tolerance (%)
DEPL	DY	$D (NI249)$	$-1.2 \times 10^{-5} m$	'ANALYTICAL'	2.1
SIGM_ELNO	SIXY	$B (N11)$	$-1.99 \times 10^5 Pa$	'ANALYTICAL'	0.1

5 Summary of the results

To model a loading under actual weight, the use of the keywords `GRAVITY` or `FORCE_INTERNE` provides the same results, in concord with the analytical solution.