

## SSLP301 – Trapezoidal plate under actual weight

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### 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

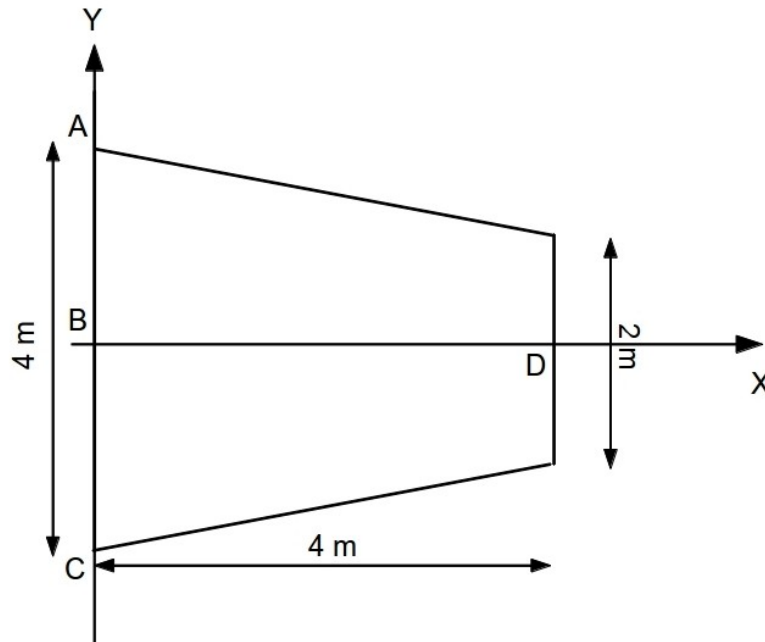


Figure 1.1 Geometry of the problem and system of loading

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

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### 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

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### 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

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### 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

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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.