

SDNL103 - Dynamics of a modelled gantry by elements of beam in great rotation. Comparison with an analysis in small rotation

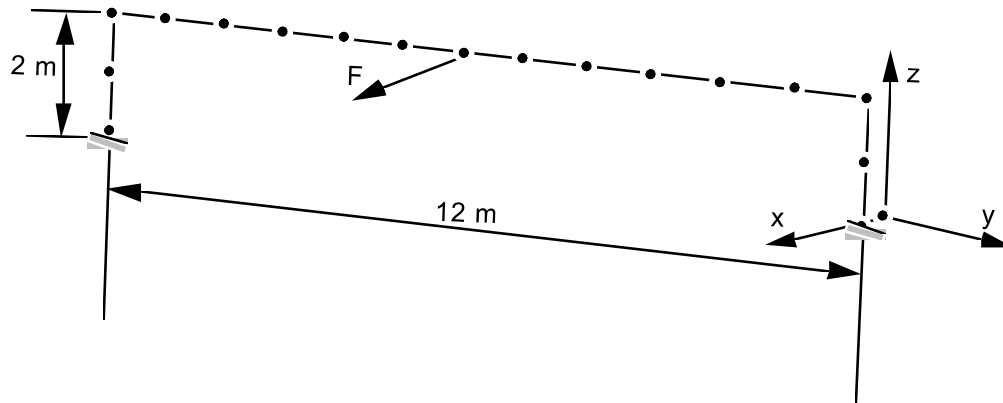
Summary:

One analyzes the answer of a gantry, embedded in feet and subjected to a dynamic force applied in the middle of his span and perpendicular to his plan. Displacements are small. Two modelings of beams are compared: POU_D_T_GD and POU_D_T.

Interest: to test the element of beam in great rotation MECA_POU_D_T_GD and orders it DYNA_NON_LINE.

1 Problem of reference

1.1 Geometry



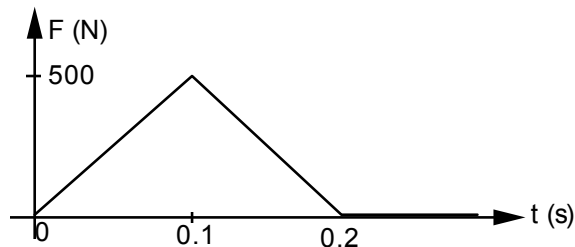
1.2 Material properties

For the span:	$E = 7. E10 Pa$	$\nu = 0.3$	$\rho = 2700 kg/m^3$
For the posts:	$E = 5. E10 Pa$	$\nu = 0.3$	$\rho = 2500 kg/m^3$

1.3 Boundary conditions and loadings

Embedding in foot of posts.

Evolution of the force F :



1.4 Initial conditions

Static position of balance; worthless speed.

2 Reference solution

2.1 Method of calculating used for the reference solution

This problem does not have an analytical solution. But, as displacements are small, one takes for reference modeling by elements of beam `POU_D_T`.

2.2 Results of reference

Displacement of the medium of the span, in the direction x at the moments: $0.14 s$; $0.26 s$; $0.36 s$ and $0.47 s$.

3 Modeling A

3.1 Characteristics of modeling

Characteristics of the span:

$$A = 2.24 E - 3 m^2 ; I_y = I_z = 3.7 E - 6 m^4 ; J_x = 7.4 E - 6 m^4 ; A_y = A_z = 1.2$$

Characteristics of the posts:

$$A = 3.14 E - 2 m^2 ; I_y = I_z = 4.5 E - 5 m^4 ; J_x = 9.0 E - 5 m^4 ; A_y = A_z = 1.2$$

The analysis relates to 0.5 s in 100 pas de equal times.

3.2 Characteristics of the grid

The span is modelled by 12 elements of beam; each post by 2 elements. All these elements have 1m of length.

3.3 Sizes tested and results

Identification	POU_D_T	POU_D_T_GD Aster	% difference
DX in $t = 1.4 E - 1$	2.9706 E-2	2.9069 E-2	- 2.1
DX in $t = 2.6 E - 1$	- 2.6290 E-2	- 2.5376 E-2	- 3.5
DX in $t = 3.6 E - 1$	2.5126 E-2	2.5147 E-2	0.08
DX in $t = 4.7 E - 1$	- 2.5488 E-2	- 2.5390 E-2	- 0.4

4 Summary of the results

The variation compared to the reference solution is to the maximum of 3,5% during the transient. The reference solution being obtained with the elements `POU_D_T`, in small displacements, this variation is thus explainable and remains weak in the course of time.