
SDLX01 - Inflection of a symmetrical gantry

Summary:

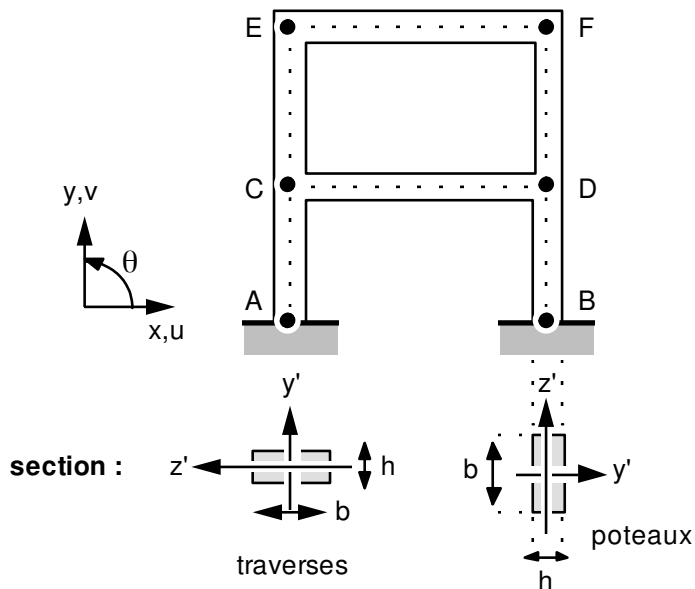
This problem plan consists in seeking the frequencies of vibration of a mechanical structure made up of an assembly of beams with rectangular section (symmetrical gantry). This test of mechanics of the structures corresponds to a dynamic analysis of an assembled structure having a linear behavior. It understands only one modeling.

Via this problem, one tests the element of beam of Timoshenko as well as the calculation of the frequencies of vibration by the method of the iterations opposite.

The got results are in very good agreement with those of guide VPCS. The error on the first thirteen frequencies of vibration is lower than 0.2%.

1 Problem of reference

1.1 Geometry



Sections droites rectangulaires :

épaisseur	$h = 0.0048 \text{ m}$
largeur	$b = 0.029 \text{ m}$
aire	$A = 1.392 \cdot 10^4 \text{ m}^2$
inertie	$I_z = 2.673 \cdot 10^{10} \text{ m}^4$

Coordinates of the points (in meters):

	A	B	C	D	E	F
x	-0.30	0.30	-0.30	0.30	-0.30	0.30
y	0.	0.	0.36	0.36	0.81	0.81

1.2 Material properties

$$E = 2.1 \cdot 10^{11} \text{ Pa}$$

$$\nu = 0.3$$

$$\rho = 7800. \text{ kg/m}^3$$

1.3 Boundary conditions and loadings

Points A and B : embedded ($u=v=0$, $\theta=0$).

1.4 Initial conditions

Without object for the modal analysis.

2 Reference solution

2.1 Method of calculating used for the reference solution

The reference solution is that given in the card SDLX01/89 guide VPCS which presents the method of calculating in the following way:

Method of the dynamic stiffness (Theory of the slim beams)

2.2 Results of reference

the first 13 Eigen frequencies.

2.3 Uncertainty on the solution

$$(\Delta f / f) < 0.5 \% .$$

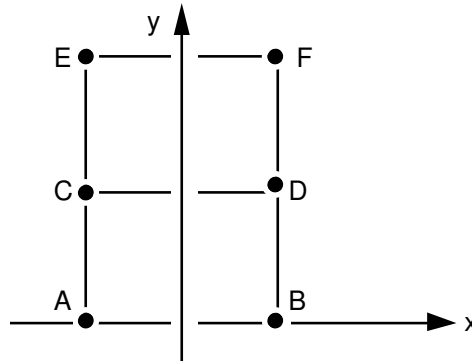
2.4 Bibliographical references

- J. PIRANDA. Course and Directed Work of vibrations of the structures. Mechanical option. École Nationale Supérieure of Mechanics and Micromechanics. Laboratory of Mechanics Applied. Besancon (France) (1983).

3 Modeling A

3.1 Characteristics of modeling

POU_D_T



Cutting:
 AC and BD 6 meshes SEG2
 CE and DF 9 meshes SEG2
 CD and EF 10 meshes SEG2

Limiting conditions:

problem plan DDL_IMPO: (ALL: 'YES' DZ: 0. , DRX: 0. , DRY
 MARTINI: 0.)
 nodes A and B embedded (GROUP_NO: AB DX: 0. , DY: 0. , DRZ:
 0.)

Name of the nodes: Point A = N100 Point B = N600
 Point C = N200 Point D = N500
 Point E = N300 Point F = N400

3.2 Characteristics of the grid

Many nodes: 50
 Many meshes and types: 50 SEG2

3.3 Values tested

Identification	Reference
1 anti	8.8
2 anti	29.4
3 sym	43.8
4 sym	56.3
5 anti	96.2
6 sym	102.6
7 anti	147.1
8 sym	174.8

9 anti	178.8
10 anti	206.0
11 sym	266.4
12 anti	320.0
13 sym	335.0

3.4 Remarks

Calculations carried out by:

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CALC_MODES
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OPTION=' AJUSTE '
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CALC_FREQ=_F (FREQ= (5. , 350.),  
             NMAX_FREQ=13)
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3.5 Contents of the file results

the first 13 Eigen frequencies (clean vectors and modal parameters).

4 Summary of the results

Precision lower than 0.2% on all the Eigen frequencies until the 13^{ème} mode.