

SSLL12 - Lattice of bars under three requests

Summary:

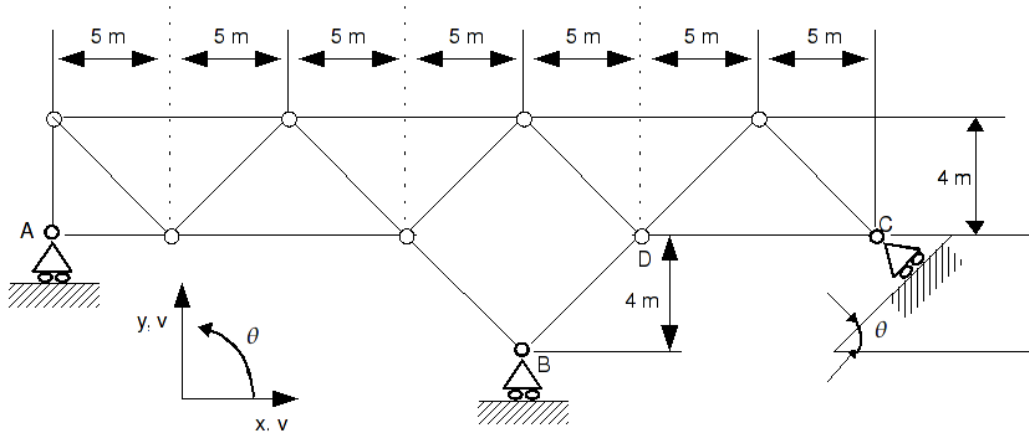
Static answer in linear mechanics of the structures of a triangulated system of pin jointed struts (lattice plan) under 3 requests:

- displacement of support,
- specific forces,
- effect of dilation.

This test makes it possible to validate the element `BAR` under various cases of loading. It validates also the option `LIAISON_OBLIQUE` order `AFFE_CHAR_MECA`.

1 Problem of reference

1.1 Geometry



1.2 Material properties

Isotropic linear elastic material: $E = 2.1 E + 11 Pa$

Linear dilation coefficient: $\alpha = 1. E - 05 ^\circ C^{-1}$

1.3 Boundary conditions and loadings

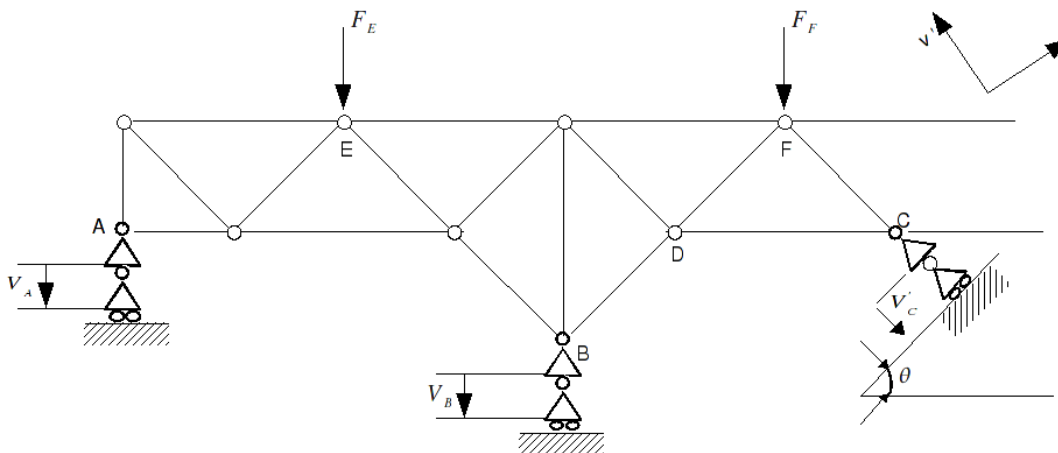
Articulation in A ($u_A = v_A = 0$).

Support with roller in B and C ($v_B = v'_C = 0$).

1.4 Initial conditions

Office plurality of 3 requests:

- displacement of support: $v_A = -0.02 m$, $v_B = -0.03 m$, $v'_C = -0.015 m$
- specific forces: $F_E = -150 kN$, $F_F = -100 kN$
- effect of dilation of all the bars for a variation in temperature of $30^\circ C$ compared to the temperature of assembly (geometry of reference).



2 Reference solution

2.1 Method of calculating used for the reference solution

Determination of the unknown the hyperstatic one by the method of cut to know the tractive effort.

2.2 Results of reference

Not	Size and unit	Value
<i>BD</i>	Tractive effort (<i>N</i>)	- 8.2112 E+03

2.3 Uncertainty on the solution

Analytical solution.

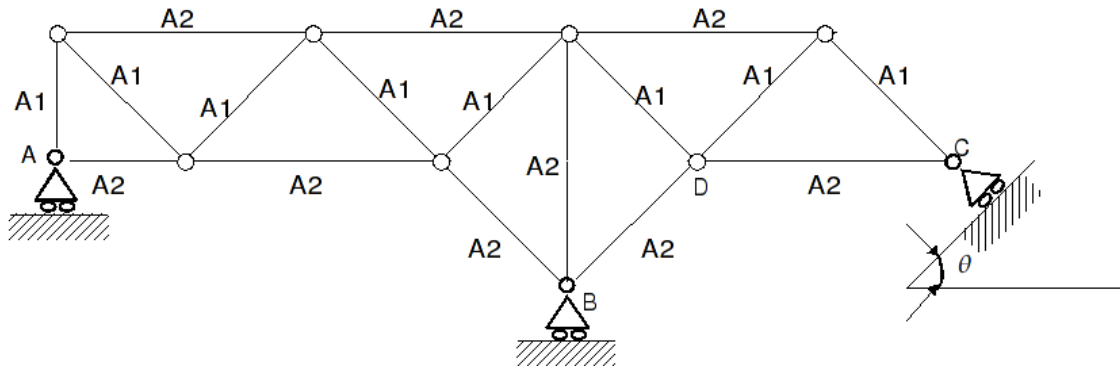
2.4 Bibliographical references

[1] Mr. LAREDO, Resistance of materials, Paris, Dunod, 1970, p. 579.

3 Modeling A

3.1 Characteristics of modeling

Type of modeling used: element BAR.



3.2 Characteristics of the grid

$$\theta = 30^\circ, A1 = 1.41 E - 03 \text{ m}^2, A2 = 2.82 E - 03 \text{ m}^2.$$

3.3 Sizes tested and results

Identification	Reference	Aster	% difference
Load: thermal dilation			
Option: 'EFGE_ELNO'			
Mesh M10, Node: B, Cmp: N	12946.	1.29541 E+04	0,063
Mesh M16, Node: C, Cmp: N	4285.2	4.28926 E+03	0,095
Mesh M17, Node: C, Cmp: N	- 10189.	- 1.02076 E+04	0,183
Load: specific forces			
Option: 'DEPL'			
Node: E, Cmp: DY	- 1.0566 E-02	- 1.05800 E-02	0,133
Option: 'EFGE_ELNO'			
Mesh M10, Node: B, Cmp: N	- 87137.	- 8.71128 E+04	- 0,028
Mesh M16, Node: C, Cmp: N	24158.	2.41596 E+04	0,007
Mesh M17, Node: C, Cmp: N	- 57524.	- 5.74954 E+04	- 0,050
Load: imposed displacements			
Option: 'EFGE_ELNO'			
Mesh M10, Node: B, Cmp: N	65979.1	6.59757 E+04	- 0,005
Mesh M16, Node: C, Cmp: N	21839.1	2.18453 E+04	0,029
Mesh M17, Node: C, Cmp: N	- 51925.6	- 5.19877 E+04	0,120
Load: office plurality of the 3 requests			
Option: 'EFGE_ELNO'			
Mesh M10, Node: B, Cmp: N	- 8211.2	- 8.18302 E+03	- 0,343
Mesh M16, Node: C, Cmp: N	50282	5.02942 E+04	0,024
Mesh M17, Node: C, Cmp: N	- 1.1964 E+05	- 1.19691 E+05	0,043

3.4 Remarks

No deformation of inflection intervenes in the calculation of the solution.

4 Summary of the results

The variations compared to the references are lower than 0.18% for the requests (thermal dilation, specific face, imposed displacement) separate and lower than 0.34% when these requests are cumulated.