SSLL12 - Lattice of bars under three requests

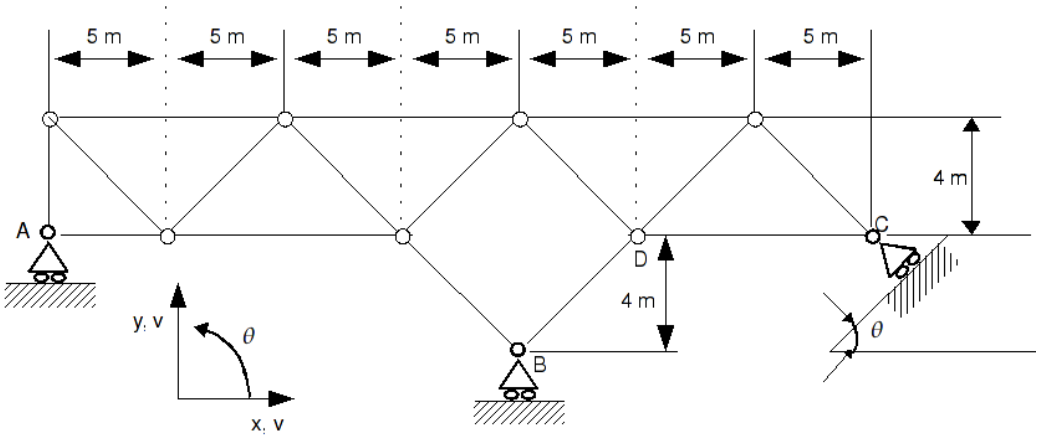
Summary:
Static answer in linear mechanics of the structures of a triangulated system of pin jointed struts (lattice plan) under 3 requests:

- 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: $E=2.1E+11\,Pa$
Linear dilation coefficient: $\alpha=1.E-05\,°C^{-1}$

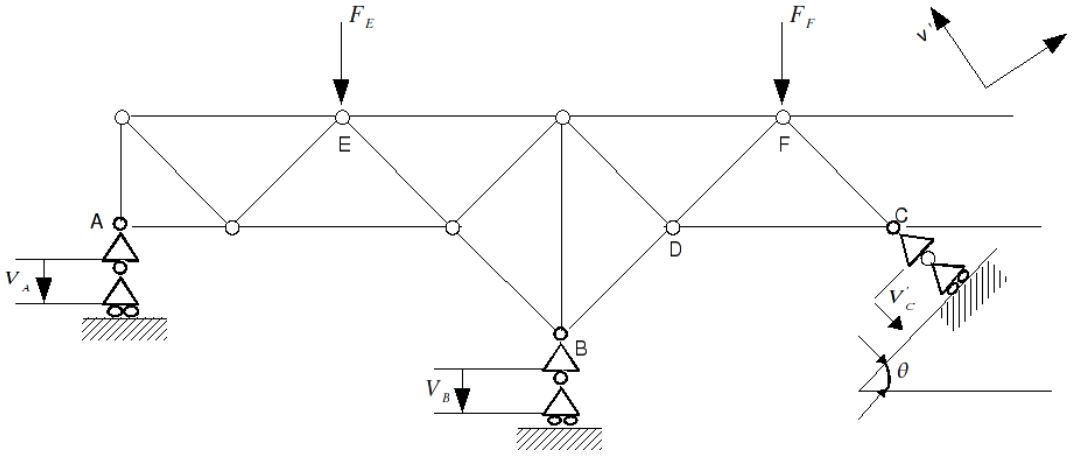
1.3 Boundary conditions and loadings

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 $30\,°C$ 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	
BD	Tractive effort (N)	– E+03	8.2112

2.3 Uncertainty on the solution

Analytical solution.

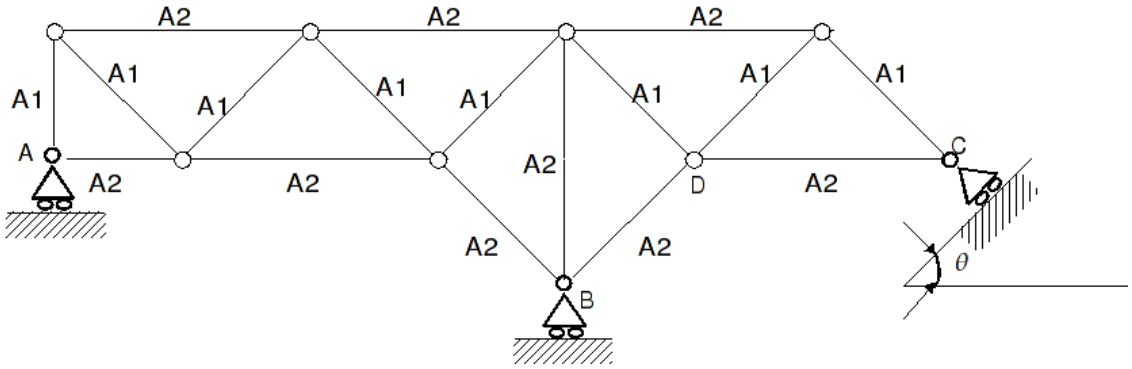
2.4 Bibliographical references

[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

$\theta = 30°$, $A1 = 1.41\,E-03\ m^2$., $A2 = 2.82\,E-03\ m^2$.

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.