SSNL123 - Buckling of a beam Multifibre

Abstract:
This test relates to the validation of the buckling of a beam multifibers with a model POU_D_TGM.
This problem makes it possible to test:
- linear finite elements of beams type with a model POU_D_TGM,
- the taking into account of the directional sense,
- the computation of the first buckling modes.

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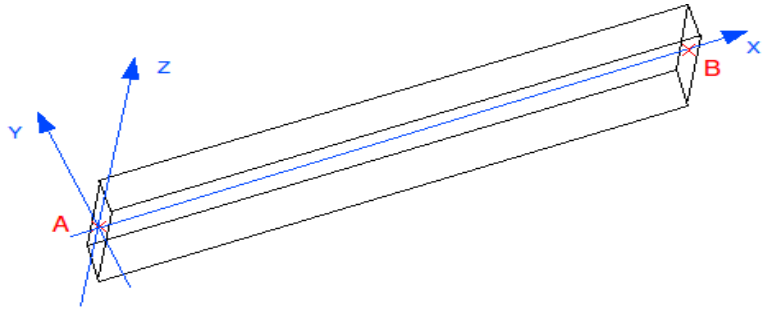
1 Problem of reference

1.1 Geometry



Length of the bar: $3\mathrm{m}$
Articulated in A
Simply supported in B
Forces in B

Section of the bar:
height: $0.04\mathrm{m}$
width: $0.02\mathrm{m}$

1.2 Properties of the material

Material for the linear element:
Elasticity: $E=2.1\mathrm{E}+11\ Pa$

1.3 Conditions with the loadings

With point: A blocking of the degrees of freedom: dx, dy, dz, DRX
With point: B blocking of the degrees of freedom : dx, dy, dz, DRX
Loading with point: B = $(F_x, 0, 0)$.

2 Quantities and

2.1 result reference solution of reference

For an bi--articulated beam, the theory of the buckling of Eulerian gives like solution:

$$Ncd = n^2 . \frac{\pi^2 EI}{L^2}$$ where n is the number of the mode.

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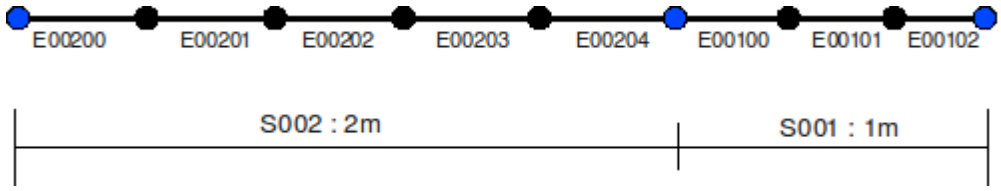
3 Modelization A

3.1 Characteristic of the modelization and the linear

mesh Element: Mechanical



POU_D_TGM Characteristics of the section (homogeneous units to meters)

A	IY	IZ	AY	AZ	JX	JG
8.0e-04	2.5e-08	1.05e-07	1.191790e+00	1.172840e+00	7.093682e-08	1.438125e-12

Loading at the point B .	Fx
Time 1	$-1\,000\,N$
Time 2	$-2\,000\,N$

3.2 Quantities tested and results

the quantities tested and analyzed are the first values of the loads of buckling in the 2 directions.

	Values Theoretical	Tolerance (%)
1st Mode/ I_z	5757.3N	0.2
1st Mode/ I_y	24180.5 N	0.2
2nd Mode/ I_z	23029.1 N	0.2
3rd Mode/ I_z	51815.4 N	0.2
2nd Mode/ I_y	96722.1 N	0.2
4th Mode/ I_z	92116.3 N	0.7

times of computation 1 and 2 give the same results. The computation vector of prestressed after the STAT_NON_LINE is thus carried out in a correct way.

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4 Summary of the results

This case test shows the good performance of a modelization of the behavior of the beams by an approach multifibers. A loop, carried out with the language python, makes it possible to recover information with different time step.

- The computation of the stiffness matrix, option RIGI_MECA, is carried out from AN AFFE_CHAR_MECA_F.
- The computation vector of the internal forces is carried out by A CREA_CHAMP from A STAT_NON_LINE by recovering THE SIEF_ELGA .

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