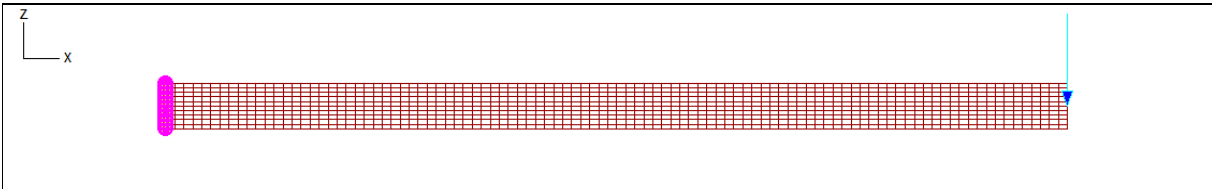


**Validation of Sargon Nonlinear solver (CURAN, version 9.60)**
**TEST MB003**    **VALIDATION, CROSS CHECKS, RELIABILITY, BENCHMARK**    Marco Croci    24/11/2010

**Test description**

Constitutive law of membranes material: linear elastic. Solution should coincide with a linear elastic solution.

Theoretical check and cross-check with Sargon linear solver (CLEVER)

 Test model: **curanMB\_003.WSR**    Target model: **C003MB\_CLEVER.WSR**
**Material properties**

Name	$\nu$	E
S235LE	0,3	210000N/mm <sup>2</sup>

**Model data**

Beam			Constraints		Load (z direction)	
LENGTH	HEIGHT	THICKNESS	LEFT	RIGHT	APPLICATION POINT	FORCE
10000mm	500mm	100mm	Fixed	Free	Right end	-100000N

Membrane elements	Type	Thickness	d.o.f.
1000 (10x100)	QUAD4SRI	100mm	2200

**CROSS CHECK**

 Displacement in the middle of the beam is  $\delta = FL^3/3EI + L\chi T/2GA$  where  $\chi$  is shear factor and T is internal shear force

Load case	Value	Unit	CURAN	TARGET	KIND	% diff.
1	Node 24 displacement (z)	mm	-1,523E+02	-1,527E+02	theoretical	-0,25
1	$\sigma_{VM}$ element 730, node 749	N/mm <sup>2</sup>	7,091E+01	7,091E+01	cross-check	0,00
1	$\sigma_z$ element 730, node 749	N/mm <sup>2</sup>	-5,533E+00	-5,533E+00	cross-check	0,00

$$\% \text{ difference} = (\text{CURAN} - \text{TARGET}) / \text{TARGET} * 100$$

Precision of limit multiplier for the analysis: 0.005

QUAD4SRI: bilinear isoparametric element with selective integration