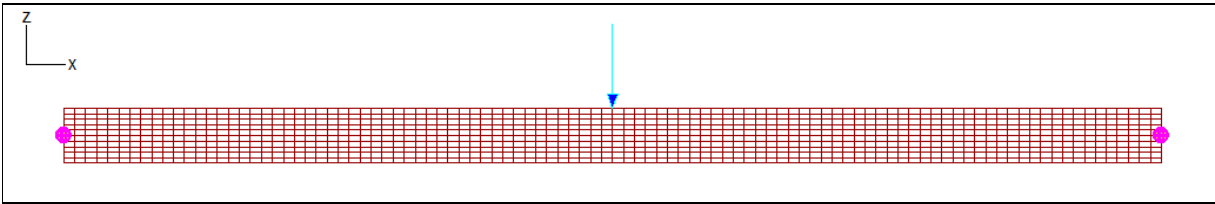


Validation of Sargon Nonlinear solver (CURAN, version 9.60)			
TEST MB010	VALIDATION, CROSS CHECKS, RELIABILITY, BENCHMARK	Marco Croci	25/11/2010



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_010.WSR	Target model: C010MB_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	Simple support	Middle point	-100000N

Membrane elements	Type	Thickness	d.o.f.
1000 (10x100)	QUAD4	100mm	2218

CROSS CHECK
-------------

Displacement in the middle of the beam is  $\delta = FL^3/48EI + L\chi T/2GA$  where  $\chi$  is shear factor and T is internal shear force

Load case	Value	Unit	CURAN	TARGET	KIND	% diff.
1	Node 127 displacement (z)	mm	-9,426E+00	-9,598E+00	theoretical	-1,79
1	$\sigma_{vm}$ element 70, node 147	N/mm <sup>2</sup>	4,684E+01	4,684E+01	cross-check	0,00
1	$\sigma_z$ element 70, node 147	N/mm <sup>2</sup>	1,362E+00	1,362E+00	cross-check	0,00

% difference = (CURAN - TARGET) / TARGET \* 100

Precision of limit multiplier for the analysis: 0.005  
 QUAD4: bilinear isoparametric element