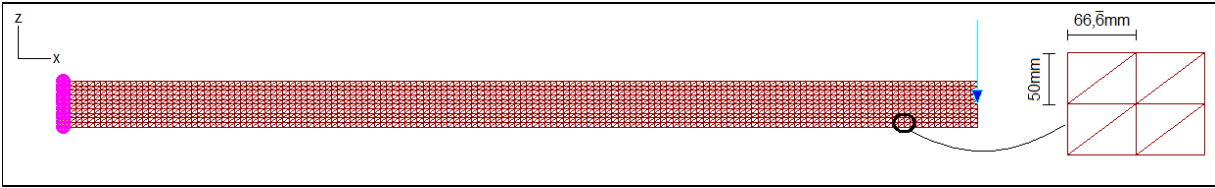


<b>Validation of Sargon Nonlinear solver (CURAN, version 9.60)</b>			
<b>TEST MB001</b>	<b>VALIDATION, CROSS CHECKS, RELIABILITY, BENCHMARK</b>	<b>Marco Croci</b>	<b>25/11/2010</b>



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: <b>curanMB_001.WSR</b>	Target model: <b>C001MB_CLEVER.WSR</b>

Material properties		
Name	ν	E
S235LE	0,3	210000N/mm <sup>2</sup>

Model data
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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.
3000	CST	100mm	3300

CHECK
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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 15 displacement (z)	mm	-1,461E+02	-1,527E+02	theoretical	-4,29
1	$\sigma_x$ element 1038, node 1149	N/mm <sup>2</sup>	-9,683E+01	-9,683E+01	cross-check	0,00
1	$\sigma_z$ element 1038, node 1149	N/mm <sup>2</sup>	-5,304E+00	-5,304E+00	cross-check	0,00

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

Precision of limit multiplier for the analysis: 0.005