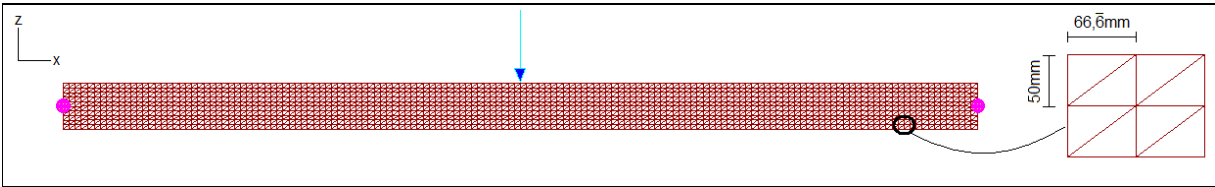


Validation of Sargon Nonlinear solver (CURAN, version 9.60)			
TEST MB009	VALIDATION, CROSS CHECKS, RELIABILITY, BENCHMARK	Marco Croci	25/11/2010



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_009.WSR	Target model: C009MB_CLEVER.WSR

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

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.
3000	CST	100mm	3318

CROSS CHECK

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

Load case	Value	Unit	CURAN	TARGET	KIND	% diff.
1	Node 844 displacement (z)	mm	-9,183E+00	-9,598E+00	theoretical	-4,32
1	σ_{vm} element 950, node 1052	N/mm ²	4,250E+01	4,250E+01	cross-check	0,00
1	σ_x element 950, node 1052	N/mm ²	4,292E+01	4,292E+01	cross-check	0,00

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

Precision of limit multiplier for the analysis: 0.005