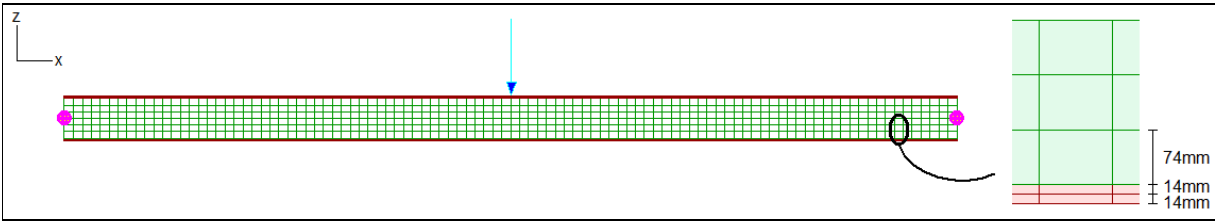


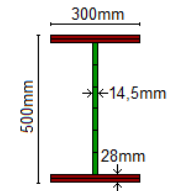
Validation of Sargon Nonlinear solver (CURAN, version 9.60)			
TEST MB022	VALIDATION, CROSS CHECKS, RELIABILITY, BENCHMARK	Marco Croci	26/11/2010



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_022.WSR	Target model: C022MB_CLEVER.WSR

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

Model data

Beam		Constraints	Load (z direction)		
LENGTH	SHAPE SIZES	LEFT / RIGHT	APPLICATION P.	FORCE	
10000mm	See image	Simple support	Middle point	-100000N	
Membrane elements		Type	Thicknesses	d.o.f.	
1000 (10x100)		QUAD4	See image	2218	

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 127 displacement (z)	mm	-9,858E+00	-9,943E+00	theoretical	-0,85
1	σ_{vm} element 248, node 266	N/mm ²	4,270E+01	4,270E+01	cross-check	0,00
1	τ_{zx} element 50, node 107	N/mm ²	3,612E+00	3,612E+00	cross-check	0,00

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

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