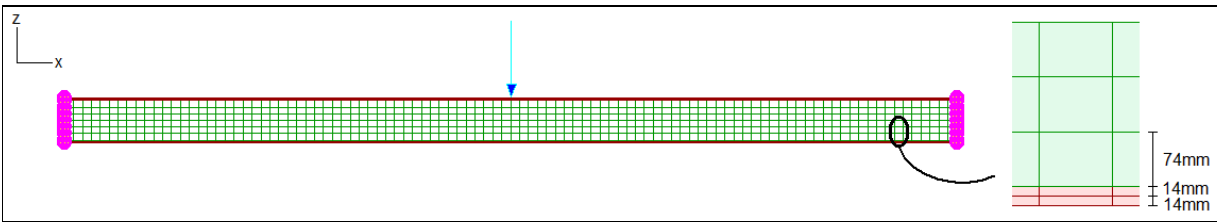


Validation of Sargon Nonlinear solver (CURAN, version 9.60)
TEST MB020
VALIDATION, CROSS CHECKS, RELIABILITY, BENCHMARK
Marco Croci
26/11/2010

Test description

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

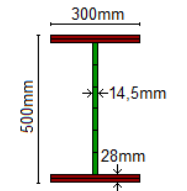
Theoretical check and cross-check with Sargon linear solver (CLEVER)

 Test model: **curanMB_020.WSR**

 Target model: **C020MB_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	Fixed	Fixed	Middle point	-100000N	
Membrane elements		Type	Thicknesses	d.o.f.		
1000 (10x100)		QM6WI	See image	2178		

CROSS CHECK

 Displacement in the middle of the beam is $\delta = FL^3/192EI + L\chi T/2GA$ 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	-2,783E+00	-2,806E+00	theoretical	-0,81
1	σ_{vm} element 778, node 796	N/mm ²	1,197E+01	1,197E+01	cross-check	0,00
1	σ_z element 976, node 994	N/mm ²	1,748E-01	1,748E-01	cross-check	0,00

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

Precision of limit multiplier for the analysis: 0.005

QM6WI: 4 nodes incompatible element with Wilson-Ibrahimbegovic modification