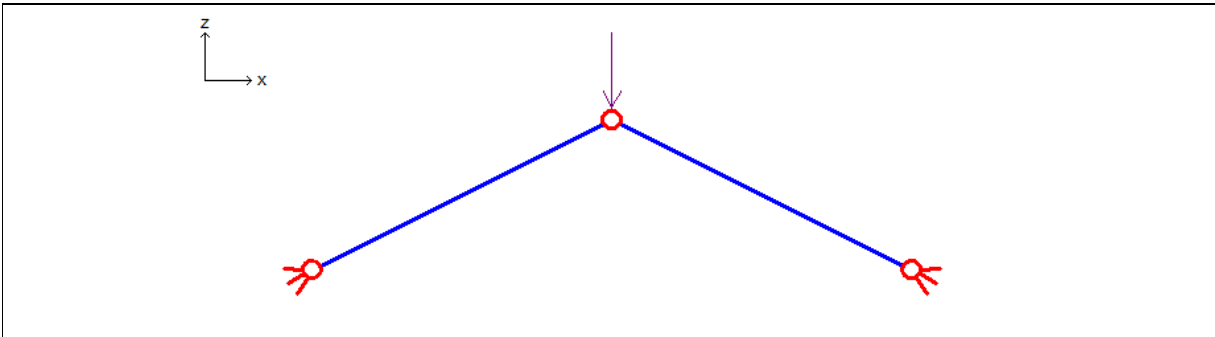


Validation of Sargon Nonlinear solver (CURAN, version 9.60)

TEST TR021

VALIDATION, RELIABILITY, BENCHMARK

Marco Croci Rev.2-06/12/2010



Test description

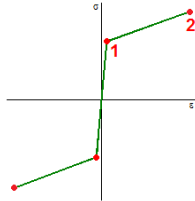
Constitutive law of trusses material: bilinear. Work hardening kind: isotropic.

This case is similar to test 011, but here load path is active: it means that load case 2 is computed starting from final condition of load case 1.

Constitutive law is elastic-plastic, is symmetrical and F_2 is equal to $-F_1$: the final condition after load case 2 should be with null internal forces, but with a residual deformation, since yield stress is exceeded in load case 1. Case 1 should coincide with case 1 of test 011.

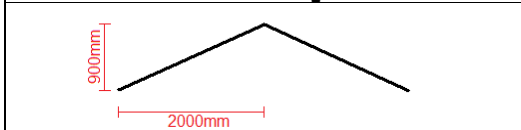
Test model: **curanTR_021.WSR**

Material properties

Name	S235BI	
ν	0,3	
ϵ_1	0,001119	
σ_1	235N/mm ²	
ϵ_0	0,02	
σ_0	360N/mm ²	

Cross-section: circular section, diameter=40mm (area=1256,64mm²)

Geometry

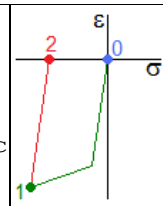


Force (z direction)

Load case 1	$F = -300000N$
Load case 2	$F = +300000N$
Load path: active	

CHECK

Case 1 should coincide with test 011 (point 1 in next figure is reached, we are in the second branch). Since work hardening is isotropic, when load case 2 is applied point 2 in the figure should be reached (null stress, residual deformation). Unloading is totally elastic, so residual displacement should be equal to the difference between displacement in case 1 and an opposite displacement in elastic field. Referring to results in test 011, final displacement should be $-51,11mm - (-7,403mm) = -43,7mm$



Load case	Value	Unit	CURAN	THEORETICAL	% diff.
1	Truss #1 normal stress	N/mm ²	-2,909E+02	-2,909E+02	0,00
1	Node #8 displacement (z)	mm	-5,109E+01	-5,111E+01	-0,03
2	Truss #1 normal stress	N/mm ²	0,000E+00	0,000E+00	0,00
2	Node #8 displacement (z)	mm	-4,369E+01	-4,370E+01	-0,03

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

Precision of limit multiplier for the analysis: 0.005