

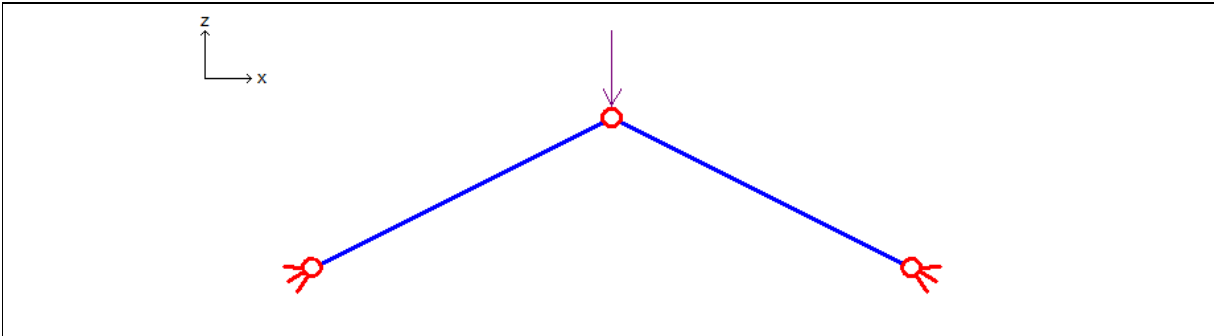
Validation of Sargon Nonlinear solver (CURAN, version 9.60)

TEST TR011

VALIDATION, RELIABILITY, BENCHMARK

Marco Croci

Rev.2-03/12/2010

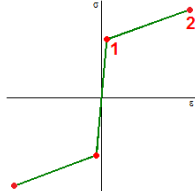


Test description

Constitutive law of trusses material: bilinear; f_y is exceeded.

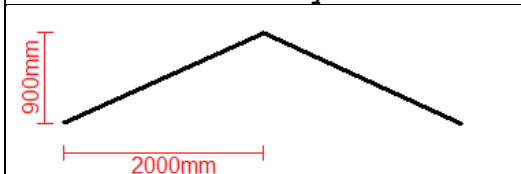
Test model: curanTR_011.WSR

Material properties

Name	S235BI	
ν	0,3	
ϵ_1	0,001119	
σ_1	235N/mm ²	
ϵ_2	0,02	
σ_2	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: not active	

CHECK

f_y should be equal to 290,9Nmm² (see test 001, linear elastic case, with a displacement equal to 0,7403mm), so we reach the second branch. Here, displacement reached at the end of the first branch is $d_1=0,740\text{mm}/290,9\text{mm}^2/235\text{mm}^2=0,598\text{mm}$; for the second branch we have the following partial displacement:
 $d_2=0,7403 \cdot (290,9/\sigma_1 - 1) / ((290,9/\sigma_1) \cdot (\sigma_1/\epsilon_1) / [(\sigma_2 - \sigma_1) / (\epsilon_2 - \epsilon_1)]) = 45,12\text{mm}$
 Total displacement is equal to $d_1 + d_2 = 51,1\text{mm}$

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	2,909E+02	2,909E+02	0,00
2	Node #8 displacement (z)	mm	5,109E+01	5,111E+01	-0,03

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

Precision of limit multiplier for the analysis: 0.005