

Validation of Sargon Nonlinear solver (CURAN, version 9.70)

TEST TG001

## VALIDATION, RELIABILITY, BENCHMARK

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## Test description

A truss has been added under the free end of a cantilever. The truss has a gap so that it starts to react after a displacement equal to 10mm. Compare this test with TEST SP005 where a spring was used instead of the truss. Test model: **curanTG\_001.WSR** 

Beam properties							
Length	Shape	Material	(indefinitely linear	elastic)			
3000mm	IPE300 J=83561000mm <sup>4</sup>	S235	$E = 210000 \text{N/mm}^2$	<b>v</b> =0,3			

Truss properties					
Length	Shape		Material (linear elastic with gap)		
1000mm	Generic A=9,286mm <sup>2</sup>	S235	$E=210000N/mm^2$ $\nu=0, 3$ $\epsilon_{\mu}=0, 02$	Gap=10mm	

Loads and constraints					
Left end	Right end	Force			
Fixed	Truss	F = -50000N			

## CHECK

Without the truss, the displacement of the simple cantilever would be equal to  $FL^3/(3EJ) = -25,64$ mm and maximum bending moment would be equal to  $F^*L=1,5^{10}$ °Nmm. After a displacement equal to -10mm the truss starts to react: in this test the value of AE/L for the truss is equal to the value of  $3EJ/L^3$  for the cantilever, so the stiffness of cantilever+truss is 2 times greater than the stiffness of the simple cantilever and the additional displacement thus results equal to [-25,64mm-(-10mm)]/2=-7,82mm. Total displacement is -10mm-7,82mm=-17,82mm. Computed moment should be equal to  $1,5^{10}$ °Nmm17,82mm/25,64mm $=1,0425^{10}$ °.

Load case	Value	Unit	CURAN	THEORETICAL	% diff.
1	Node 8 displacement (z)	mm	-1,782E+01	-1,782E+01	0,00
1	Beam #1 max bending moment	Nmm	1,042E+08	1,043E+08	-0,01

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

Precision of limit multiplier for the analysis: 0.005