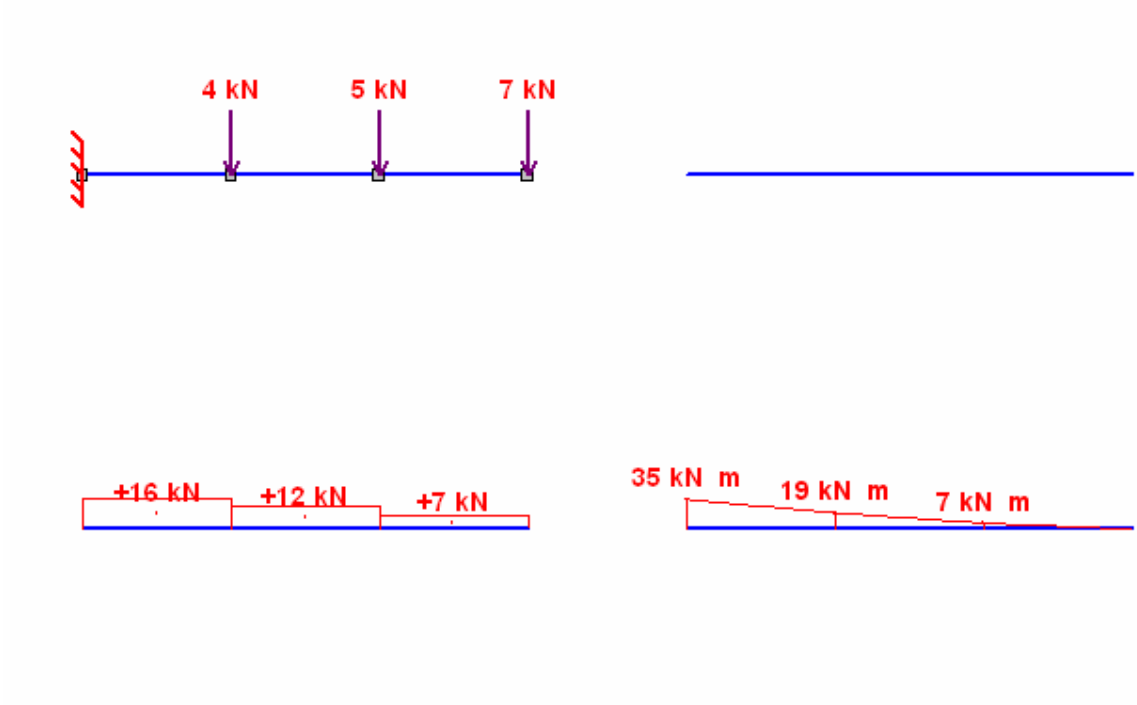
TEST SCHEDULE CASTALIA_STAT004		
SOLVING	BEAM PROBLEM	**SOL.SAR.STAT004**
FINITE ELEMENT	SOLVER	**CLEVER (SARGON ©)**



Problem description:

Cantilever with end and internal shear forces

Keywords (english): validation, benchmark, statics, finite elements, fem, solver, precision, reliability, quality control, beam, error measure

Keywords (italian): validazione, benchmark, statica, elementi finiti, fem, solutore, precisione, affidabilità, controllo qualità, travi, misura di errore

Editorial note:

Picture are from program CESCOPLUS, a plane frame program by Castalia srl. CESCOPLUS uses its own solver to compute displacement and stresses. Target values are based on theoretical values, cross check values or accepted values. Where “theoretical” values are used, target values have been computed using well known formulae and/or published results, they have absolutely not been taken equal to those shown in pictures, which have been obtained by CESCOPLUS (since this schedule tests Sargon, the check would have otherwise been a cross check between CESCOPLUS and SARGON). Target values equalness with picture values – if shown - is thus a consequence of CESCOPLUS precision, the assessment of which is not the main goal of this schedule. CESCOPLUS results are shown to easy the careful cheking of stress state and the understanding of the test itself. Since Sargon is a 3D program its graphical conventions about constraints are not as easy to understand as those of CESCOPLUS, that’s why CESCOPLUS pictures have been used to describe the problem.

Note:

Shear area is not used, that is shear energy neglected. Dxi and Dzi are the offsets from lower Z alignment leftmost available node.

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GEOMETRY & CONSTRAINTS				
Full Length [mm]	Dx1 [mm]	Dx2 [mm]		Constraints
3000	1000	2000	-	As shown

LOAD

Type	Value	Point of application
NODAL FORCE	7.000e+003	Free tip
NODAL FORCE	5.000e+003	Dx2
NODAL FORCE	4.000e+003	Dx1
		-

MATERIAL						**Fe360**
f_y [N/mm^2]	f_u [N/mm^2]	E [N/mm^2]	v	α		
2.350e+002	3.600e+002	2.060e+005	3.000e-001	1.200e-005		

CROSS-SECTION					**IPE200**
A [mm^2]	J_2[mm^4]	J_3 [mm^4]	J_t [mm^4]	W_2 [mm^3]	W_3 [mm^3]
2.981e+003	2.051e+007	1.540e+006	6.254e+004	2.051e+005	3.081e+004
W_{pl2} [mm^3]	W_{pl3} [mm^3]	i_2 [mm]	i_3 [mm]	i_t [mm]	
2.597e+005	4.776e+004	8.296e+001	2.273e+001	2.887e+001	

OTHER DATA

TARGET VALUES vs COMPUTED VALUES

Description	T_v	T_{vK}	C_v	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.6000e+004	Th	1.6000e+004	**1.7462e-010**	**0.0000**
Shear T3, I extreme. Beam # 2. Load case # 1	1.2000e+004	Th	1.2000e+004	**8.7311e-011**	**0.0000**
Bending M2, I extreme. Beam # 2. Load case # 1	-1.9000e+007	Th	-1.9000e+007	**-1.6391e-007**	**0.0000**
Bending M2, I extreme. Beam # 3. Load case # 1	-7.0000e+006	Th	-7.0000e+006	**-1.0431e-007**	**0.0000**

Cv computed value
Tv target value
TvK target value kind (theoretical, cross check, accepted).
- Th theoretical value
- Cr cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
- Ac accepted value (a value which, on the basis of some argument, can be considered acceptable).

100(Cv – Tv) / Tv relative error percentage

Computational notes:

Authors: Ing. Marco Croci, Ing. Paolo Rugarli
Computed errors: checksolvers.exe, by Castalia srl.