





These test are mainly intented to prove Sargon static solver reliability, and are a first set of tests regarding "main beams", that is simple beam models easy to check by hand or using published data. Since in statically indeterminate structure results depend on shear areas, and since usually published results do not take into account the effect of shear deformation energy, shear areas have in these cases been set to 0, thus neglecting shear energy contributions. These tests do use notional section data values, such as 1 for second moment of area and so on.

The results obtained are always quite satisfactory, that is error are always almost unexistent. Sometimes the need of defining numbers having periodic set of digits (e.g. 1/3) can lead to error different from 0.

Setting up benchmarks like these is not a trivial matter. Extensive work has been done to assure the highest reliability of all data. Errors have been computed automatically by program "checksolvers", a software testing tool developed by Castalia srl.

This work is open and can be used elsewhere. We ask, nonetheless, to be informed of any use of these data and we ask that these data are used but citing the source, that is the following:

"Data have been computed by Castalia srl for its fem static solver "CLEVER" validation. Castalia srl: <u>http://www.castaliaweb.com</u> "

"Questi dati sono stati calcolati da Castalia srl per la validazione del proprio solutore statico fem CLEVER. Castalia srl: <u>http://www.castaliaweb.com</u>"

Milan, May 2007





Problem description:

Cantilever with end shear force

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT001		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT001
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	OMETRY 8		ISTRAIN	NTS				
Full Length	[mm]									C	onstraints
3000				-			-		-	1	As shown
LOAD											
	Туре			,	Value			P	oint of applica	ation	
NOD	AL FORC	E		7.0)00e+(003			Free tip		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	ım²]	E [N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0)05			
CROSS-SECTIC	N									I	PE200
A [mm ²]		J₂[mm⁴]		J₃ [mr	n⁴]	J	t[mm⁴]	1	W ₂ [mm ³]	W	3 [mm ³]
2.981e+003	2	051e+00	7	1.540e	+006	6.2	254e+004	2	.051e+005	3.0)81e+004
W _{pl2} [mm ³]	W	/ _{pl3} [mm ³]		i ₂ [mi	m]	ig	₃[mm]		i _t [mm]		
2.597e+005	4.	776e+00	4	8.296e+00		2.2	2.273e+001		.887e+001		
OTHER DATA											

TARGET	VALUES
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COMPUTED VALUES

Description	T _v	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	7.0000e+003	Th	7.0000e+003	0.0000e+000	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	-7.0000e+003	Th	-7.0000e+003	0.0000e+000	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-2.1000e+007	Th	-2.1000e+007	0.0000e+000	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Cv – Tv) / Tv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage
Computational note	

Computational notes:

Authors: Computed errors:





Problem description:

Cantilever with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT002		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT002
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		GI	EOMETRY &	& CONS	STRAIN	ITS				
Full Length [mm]								Co	nstraints
3000			-			-		-	A	s shown
LOAD										
	Гуре			Value			Po	int of application	ation	
force of	distribute	d	2.5	570e+0	00			-		
								-		
								-		
								-		
MATERIAL										Fe360
f _v [N/mm ²]	f _u [N/m	m²] E	[N/mm ²]	1	v	α				
2.350e+002	3.600e	+002 2	.060e+005	3.000	De-001	1.200e-0	005			
CROSS-SECTIO	Ν								IP	E200
A [mm ²]		J₂[mm⁴]	J₃ [m	m⁴]	J	t[mm⁴]	٧	V ₂ [mm ³]	W ₃	[mm ³]
2.981e+003	2.	051e+007	1.540€	e+006	6.2	54e+004	2.	051e+005	3.08	31e+004
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [m	m]	i,	3 [mm]		i _t [mm]		
2.597e+005	4.	776e+004	8.2966	e+001	2.2	73e+001	2.	887e+001		
OTHER DATA	OTHER DATA									

TARGET VALUES

COMPUTED VALUES

Description	T _v	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	7.7100e+003	Th	7.7100e+003	-1.8190e-012	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	1.3642e-012	1.3642e-012	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.1565e+007	Th	-1.1565e+007	3.7253e-009	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	3.2596e-009	3.2596e-009	0.0000

vs

Cv Tv TvK	computed value target value target value kind	(theoretical, cross check, accepted).
	Th Cr	theoretical value 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 - Iv) / Iv	relative error perc	centage
Commutational mate		

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT003		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT003
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Cantilever with distributed linear load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT003		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT003
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEO	OMETRY 8		STRAIN	NTS				
Full Length	[mm]]								Co	onstraints
3000									-	A	s shown
LOAD]										
	Туре	e			Value			Po	pints of applic	ation	
force linearly distributed			2.570e+000- 0.000e+000				-				
						-					
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u	[N/mm ²]	E [[N/mm ²]	١	/	α				
2.350e+002	3.6	600e+002	2.0	60e+005	3.000)e-001	1.200e-0	005			
CROSS-SECTIO	ON									IP	E200
A [mm ²]		J₂[mm ⁴]	J₃[mı	m⁴]	J	t[mm ⁴]		W ₂ [mm ³]	W ₃	[mm ³]
2.981e+003	3	2.051e+	007	1.540e	+006	6.2	254e+004	2	2.051e+005	3.08	31e+004
W_{pl2} [mm ³] W_{pl3} [mm ³]		i ₂ [m	i₂[mm]		₃[mm]		i _t [mm]				
2.597e+005 4.776e+004		8.2966	8.296e+001		73e+001	2	2.887e+001				
OTHER DATA											
1											

TARGET VALUES

COMPUTED VALUES

Description	T_{ν}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.8550e+003	Th	3.8550e+003	9.0949e-013	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.5475e-013	-4.5475e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-3.8550e+006	Th	-3.8550e+006	-5.5879e-009	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-6.9849e-010	-6.9849e-010	-0.0000

vs

Cv	computed
Tv	target valu
TvK	target valu

ue target value kind (theoretical, cross check, accepted).

value

Th Cr theoretical value

cross check value (theoretical target value is not known, results obtained with a different 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: Computed errors:





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:

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Note:



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

GEOMETRY & CONSTRAINTS											
Full Length	[mm]		Dx1	l [mm]			Dx2 [mm]			(Constraints
3000			1	000			2000		-		As shown
LOAD											
	Туре			,	Value			Po	int of applica	ation	
NOD	AL FORC	Έ		7.0	00e+0	03			Free tip		
NOD	AL FORC	Έ		5.0	00e+0	03			Dx2		
NOD	AL FORC	Έ		4.0	00e+0	03			Dx1		
						-					
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/n	ım²]	E [l	N/mm ²]		ν α					
2.350e+002	3.6006	+002	2.06	60e+005	3.00	00e-001 1.200e-005		005			
CROSS-SECTIO	ON										PE200
A [mm ²]		J₂[mm ⁴]		J₃ [mr	n⁴]	J	[mm ⁴]	V	V ₂ [mm ³]	۷	√ ₃ [mm³]
2.981e+003	3 2	.051e+0	07	1.540e	+006	6.2	6.254e+004		051e+005	3.	081e+004
W _{pl2} [mm ³]	V	/ _{pl3} [mm	3]	i₂[mı	m]	i ₃ [mm] i _t [mm]		i _t [mm]			
2.597e+005	5 4	.776e+0	04	8.296e	+001	2.273e+001 2.8		887e+001			
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
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

vs

Cv Tv TvK	computed value target value 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).
100(Cv – Tv) / Tv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT004BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT004BIS
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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT004BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT004BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS										
Full Length	[mm]	D	0x1 [mm]	mm] Dx2 [mm]					Co	onstraints
3000			1000			2000		-	A	s shown
LOAD										
	Туре			Value			Poir	nt of applica	ation	
NOD	AL FORCI	Ε	7.0)00e+0)03			Free tip		
force of	concentrat	ed	4.0)00e+0	003			Dx1		
force of	concentrat	ed	5.0)00e+0	003			Dx2		
					-					
MATERIAL										Fe360
f _v [N/mm ²]	f _u [N/mi	m²] E	[N/mm ²]		να					
2.350e+002	3.600e-	-002 2	.060e+005	3.00	00e-001 1.200e-00		005			
CROSS-SECTIO	ON								IP	E200
A [mm ²]		l₂[mm⁴]	J₃[m	m⁴]	J	[mm ⁴]	W	₂ [mm ³]	Wa	[mm ³]
2.981e+003	3 2.0	051e+007	1.540€	900+	6.254e+004		2.0	51e+005	3.08	31e+004
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [m	m]	i ₃ [mm] i _t [m		[mm]			
2.597e+005	5 4.1	776e+004	8.2966	e+001	2.273e+001 2.88		87e+001			
OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.6000e+004	Th	1.6000e+004	-5.4570e-012	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	-7.0000e+003	Th	-7.0000e+003	5.4570e-012	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-3.5000e+007	Th	-3.5000e+007	-1.0000e-001	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	3.7253e-009	3.7253e-009	0.0000

vs

Cv	computed value
Tv	target value
TvK	target value kind

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). accepted value (a value which, on the basis of some argument, can be considered acceptable).

Ac 100(Cv - Tv) / Tv relative error percentage

Computational notes:

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





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

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Note:



TEST SCHEDULE CASTALIA STAT005

SOLVING	BEAM PROBLEM	SOL.SAR.STAT005
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEO	OMETRY 8		STRAIN	ITS				
Full Length	[mm]									Co	nstraints
3000				-			-		-	A	s shown
LOAD]										
	Туре			,	Value			Р	oint of application	ation	
force line	early di	stributed		2.5 1.2	70e+00 80e+00)0-)0	-				
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N	J/mm²]	E	[N/mm ²]	L	/	α				
2.350e+002	3.60	00e+002	2.0)60e+005	3.000)e-001	1.200e-0	005			
CROSS-SECTIO	ON									IP	E200
A [mm ²]		J₂[mm'	4]	J ₃ [m	m⁴]	J	[mm ⁴]		W_2 [mm ³]	W ₃	[mm ³]
2.981e+003	3	2.051e+	2.051e+007		+006	6.2	54e+004	2	2.051e+005	3.08	31e+004
W _{pl2} [mm ³]		W _{pl3} [mm ³]		i ₂ [m	m]	ig	₃ [mm]		i _t [mm]		
2.597e+005	05 4.776e+004		8.2966	e+001 2		73e+001	2	2.887e+001			
OTHER DATA											
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{ν}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	5.7750e+003	Th	5.7750e+003	1.8190e-012	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-9.0949e-013	-9.0949e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-7.6950e+006	Th	-7.6950e+006	-4.6566e-009	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-2.3283e-010	-2.3283e-010	-0.0000

vs

Cv	computed value
Tv	target value
TvK	target value kind

arget value

target value kind (theoretical, cross check, accepted). theoretical value Th

Cr

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

Ac 100(Cv - Tv) / Tv relative error percentage

Computational notes:

Authors: Computed errors:





Problem description:

Cantilever with distributed internal constant load (clamped side)

- 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

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Note:



TEST SCHEDULE CASTALIA_STAT006		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT006
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS								7			
Full Length	[mm]	1m] Dx1 [mm]								С	onstraints
3000			2	2000			-		-	ŀ	As shown
LOAD											
	Туре			,	Value			Р	oint of applica	ation	
force	distribute	d		2.5	570e+0	00		(Clamped tip-I	Dx1	
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²]	,	v	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	DN									I	2E200
A [mm ²]		J₂[mm⁴]		J₃ [mr	n⁴]	J _t [mm⁴]			W ₂ [mm ³]	W	₃ [mm ³]
2.981e+003	2.	051e+0	07	1.540e	+006	6.2	254e+004	2	2.051e+005	3.0	81e+004
W _{pl2} [mm ³]	W	/ _{pl3} [mm	_{pl3} [mm ³] i ₂ [mm]		m]	ię	₃[mm]		i _t [mm]		
2.597e+005	4.	776e+0	04	8.296e+00		2.2	273e+001	2	2.887e+001		
OTHER DATA	OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	5.1400e+003	Th	5.1400e+003	9.0949e-012	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-9.0949e-012	-9.0949e-012	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-5.1400e+006	Th	-5.1400e+006	-2.8871e-008	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	1.0710e-008	1.0710e-008	0.0000

vs

Cv Tv TvK	computed value target value target value kind (theoretical, cross check, accepted).	
	Th theoretical value Cr cross check value (theoretical target value is not know program are used as target values).	wn, results obtained with a different
100(Cv – Tv) / Tv	Ac accepted value (a value which, on the basis of some relative error percentage	argument, can be considered acceptable).
Computational note	05'	

Computational notes:

Authors: Computed errors:





Problem description:

Cantilever with distributed internal constant load (clamped side)

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT006BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT006BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS]			
Full Length	[mm]		Dx ⁻	1 [mm]						C	onstraints
3000			2	2000			-		-	A	ls shown
LOAD]										
	Туре)		,	Value			Poin	t of applica	tion	
force line	arly d	listributed		2.57 2.5	70e+00 70e+0	00- 00		Cla	mped tip-D	x1	
									-		
									-		
							-				
MATERIAL]							Fe360			
f _y [N/mm ²]	f _u [[N/mm ²]	E [I	N/mm²]		V	α				
2.350e+002	3.6	600e+002	2.0	60e+005	3.00	0e-001	1.200e-0	05			
CROSS-SECTIO	ON									IF	E200
A [mm ²]		J₂[mm ⁴]	J₃ [mi	n⁴]	J	t[mm ⁴]	W2	[mm ³]	W	₃ [mm ³]
2.981e+003	3	2.051e+	007	1.540e	+006	6.2	54e+004	2.05	51e+005	3.0	81e+004
W _{pl2} [mm ³]		W _{pl3} [mn	n ³]	i ₂ [mm] i ₃		3 [mm]	i _t	[mm]			
2.597e+00	5	4.776e+	004	8.296e+001 2.27		73e+001	2.88	37e+001			
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	5.1400e+003	Th	5.1400e+003	2.5700e-004	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-5.1400e+006	Th	-5.1400e+006	-5.1400e-001	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-6.9849e-010	-6.9849e-010	-0.0000

vs

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.





Problem description:

Cantilever with distributed internal constant load (free tip side)

- 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 gualità, travi, misura di errore

Editorial note:

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Note:



TEST SCHEDULE CASTALIA_STAT007		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT007
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		G	EOMETRY &	& CON	STRAIN	ITS				7
Full Length	n [mm] Dx1 [mm]								Co	onstraints
3000			1000			-		-	A	s shown
LOAD										
	Туре			Value			Po	int of applica	ation	
force	distribute	d	2.5	570e+C	000			Dx1-Free ti	р	
								-		
								-		
								-		
MATERIAL										Fe360
f _v [N/mm ²]	f _u [N/m	m²] [E [N/mm²]		V	α				
2.350e+002	3.600e-	+002 2	2.060e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIC	N								IP	E200
A [mm ²]		J ₂ [mm ⁴]	J ₃ [m	m⁴]	J _↑ [mm ⁴]		V	V ₂ [mm ³]	W _a	₃ [mm ³]
2.981e+003	2.	051e+007	1.5406	e+006	6.2	54e+004	2.	051e+005	3.0	81e+004
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [m	m]	ia	[mm]		i _t [mm]		
2.597e+005	4.	776e+004	8.2966	e+001	2.2	73e+001	2.	887e+001		
OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	5.1400e+003	Th	5.1400e+003	1.4552e-011	0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-3.6380e-012	-3.6380e-012	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.0280e+007	Th	-1.0280e+007	-1.4901e-008	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	5.1400e+006	Th	5.1400e+006	7.4506e-009	0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage
Computational pate	

Computational notes:

Authors: Computed errors:





Problem description:

Cantilever with distributed internal constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT007BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT007BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8		ISTRAIN	ITS				
Full Length	Full Length [mm] Dx1 [mm]									С	onstraints
3000			1	000			-		-	ļ	As shown
LOAD											
	Туре			,	Value			Poi	nt of applica	ation	
force line	arly distri	buted		2.5 2.5	70e+0 70e+0)00- 00			Dx1-Free tip	C	
									-		
									-		
									-		
MATERIAL	MATERIAL									Fe360	
f _y [N/mm ²]	f _u [N/m	nm²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	ON									IF	PE200
A [mm ²]		J₂[mm⁴]	J₃ [mi	m⁴]	J	t[mm⁴]	N	I_2 [mm ³]	W	₃ [mm ³]
2.981e+003	3 2	.051e+	007	1.540e	+006	6.2	54e+004	2.0)51e+005	3.0	81e+004
W _{pl2} [mm ³]	V	/ _{pl3} [mn	າ"]	i ₂ [m	m]	i,	₃[mm]	i	t[mm]		
2.597e+005	5 4	.776e+	004	8.296e	96e+001 2.2		73e+001	2.8	387e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	Τ _ν	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	5.1400e+003	Th	5.1400e+003	2.5700e-004	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.5475e-013	-4.5475e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.0280e+007	Th	-1.0280e+007	-2.5700e-001	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-6.9849e-010	-6.9849e-010	-0.0000

vs

Cv	computed value	
Τv	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(Tv - Cv) / Cv relative error percentage

Computational notes:

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





Problem description:

Cantilever with internal shear force

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:

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Note:



TEST SCHEDULE CASTALIA_STAT008		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT008
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8	CON	STRAIN	ITS]
Full Length	[mm]	Dx1 [mm]					Co	onstraints			
3000			2	2000			-		-	A	s shown
LOAD]										
	Туре			,	Value			Po	oint of application	ation	
NOD	AL FOR	CE		7.0)00e+C	03			Dx1		
									-		
									-		
	-										
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N∕r	nm²]	E [I	N/mm²]		V	α				
2.350e+002	3.600	+002	2.0	60e+005	3.00	0e-001	e-001 1.200e-0				
CROSS-SECTIO	ON									IP	'E200
A [mm ²]		J ₂ [mm ⁴]	J₃ [mi	m⁴]	J	[mm ⁴]	/	V₂[mm³]	Wa	₃ [mm ³]
2.981e+003	3 2	.051e+	007	1.540e	+006	6.2	54e+004	2	.051e+005	3.0	81e+004
W _{pl2} [mm ³]	١	V _{pl3} [mn	n ³]	i ₂ [m	m]	ig	₃ [mm]		i _t [mm]		
2.597e+005	5 4	.776e+	004	8.2966	8.296e+001		73e+001	2	.887e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	7.0000e+003	Th	7.0000e+003	3.6380e-011	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	-7.0000e+003	Th	-7.0000e+003	-3.6380e-011	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.4000e+007	Th	-1.4000e+007	-1.0803e-007	0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-1.8626e-008	-1.8626e-008	-0.0000

vs

Cv Tv TvK	computed value target value target value kind (theoretical.	cross check. accepted).
	Th theoretic Cr cross ch program	al value eck value (theoretical target value is not known, results obtained with a different are used as target values).
100(Tv – Cv) / Cv	Ac accepted relative error percentage	value (a value which, on the basis of some argument, can be considered acceptable).

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT008BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT008BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)





Problem description:

Cantilever with internal shear force

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT008BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT008BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8		ISTRAIN	ITS				
Full Length	[mm]		Dx1	1 [mm]							Constraints
3000			2	2000			-		-		As shown
LOAD											
	Туре			1	Value			Po	int of applica	ation	
force o	oncentrat	ed		7.0	00e+0	003			Dx1		
									-		
									-		
									-		
MATERIAL										Fe360	
f _v [N/mm ²]	f _u [N/mi	n²]	E [l	N/mm ²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	0e-001	1.200e-0)05			
CROSS-SECTIO	ON										IPE200
A [mm ²]		$l_2[mm^4]$		J₃[mr	m⁴]	J	[mm ⁴]	V	$V_2 [mm^3]$	1	W_3 [mm ³]
2.981e+003	3 2.0)51e+0	07	1.540e	+006	6.2	54e+004	2.	051e+005	3	.081e+004
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [mr	m]	ig	_a [mm]		i _t [mm]		
2.597e+005	5 4.1	776e+0	e+004 8.296e+00 ⁻			2.2	73e+001	2.	887e+001		
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	7.0000e+003	Th	7.0000e+003	-1.8190e-012	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	1.8190e-012	1.8190e-012	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.4000e+007	Th	-1.4000e+007	-7.0000e-001	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	1.8626e-009	1.8626e-009	0.0000

Cv computed value Tv TvK

target value

target value kind (theoretical, cross check, accepted). Th

theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable).

Ac

100(Tv - Cv) / Cv relative error percentage

Computational notes:

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

Cr





Problem description:

Cantilever with end bending moment

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 gualità, travi, misura di errore

Editorial note:

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Note:



TEST SCHEDULE CASTALIA_STAT009 SOLVING BEAM PROBLEM SOL.SAR.STAT009 FINITE ELEMENT SOLVER CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [mm]									С	onstraints
3000				-			-		-	ŀ	As shown
LOAD											
	Туре				Value			P	pint of applic	ation	
NODAL		١T		2.0)00e+	007			Free tip		
									-		
									-		
									-		
MATERIAL									Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [I	[N/mm ²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005 3.00		00e-001	1.200e-	005			
CROSS-SECTION										I	PE200
A [mm ²]		l ₂ [mm ⁴]		J₃ [mm⁴]		J	t[mm ⁴]	1	N ₂ [mm ³]	W	₃ [mm ³]
2.981e+003	2.)51e+0	07	1.540e	+006	6.2	254e+004	2	.051e+005	3.0	81e+004
W _{pl2} [mm ³]	W _{pl3} [mm ³]		3]	i ₂ [m	m]	i,	₃ [mm]		i _t [mm]		
2.597e+005	5 4.776e+004		8.296e+001		2.2	273e+001	2	.887e+001			
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	Τ _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	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-2.0000e+007	Th	-2.0000e+007	-7.4506e-009	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	2.0000e+007	Th	2.0000e+007	0.0000e+000	0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage

Computational notes:

Authors: Computed errors:





Problem description:

Cantilever with distributed linear load (most loaded tip)

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT010		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT010
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©

			GEC	OMETRY 8		ISTRAIN	NTS				
Full Length	[mm]								C	constraints	
3000				-			-		-		As shown
LOAD]										
	Туре				Value			F	oint of applic	ation	
force line	early dis	tributed		0.0 2.5	00e+0 70e+0)00-)00					
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N	/mm²]	Ε[[N/mm ²]		V	α				
2.350e+002	3.60	0e+002	2.0	60e+005	3.00	00e-001	1.200e-0)05			
CROSS-SECTIO	ON									I	PE200
A [mm ²]		J₂[mm'	¹]	J₃[mı	m⁴]	J	t[mm⁴]		W_2 [mm ³]	W	/ ₃ [mm ³]
2.981e+003	3	2.051e+007		1.540e	+006	6.2	254e+004		2.051e+005	3.0)81e+004
W _{pl2} [mm ³]		W _{pl3} [mm ³]		i ₂ [m	m]	i	₃[mm]		i _t [mm]		
2.597e+005	2.597e+005 4.776e+004			8.296e+001		2.2	273e+001		2.887e+001		
OTHER DATA]										

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.8550e+003	Th	3.8550e+003	-1.8190e-012	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	9.0949e-013	9.0949e-013	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-7.7100e+006	Th	-7.7100e+006	3.7253e-009	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	1.6298e-009	1.6298e-009	0.0000

vs

Cv	computed value
Tv	target value
TvK	target value kind

get value

target value kind (theoretical, cross check, accepted). theoretical value Th

Cr

cross check value (theoretical target value is not known, results obtained with a different Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). 100(Tv - Cv) / Cv relative error percentage

Computational notes:

Authors: Computed errors:





Problem description:

Simply supported beam with internal shear force

- 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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT011		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT011
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		GEOMETRY & CONSTRAINTS									
Full Length	[mm]		Dx1								Constraints
3000			2	2000			-		-		As shown
LOAD											
	Туре			,	Value			Po	pint of application	ation	
NOD	AL FOF	CE		7.0	00e+0	003			Dx1		
									-		
									-		
									-		
MATERIAL									Fe360		
f _v [N/mm ²]	f _u [N∕	mm²]	E [I	E [N/mm ²]		ν α					
2.350e+002	3.600	e+002	2.0	60e+005 3.0		0e-001	1.200e-0)05			
CROSS-SECTIO	ON										IPE200
A [mm ²]		J ₂ [mm ⁴]	J ₃ [mn		J	[mm ⁴]	1	N ₂ [mm ³]	1	<i>N</i> ₃ [mm ³]
2.981e+003	3	2.051e+	007	1.540e	+006	6.2	54e+004	2	.051e+005	3	.081e+004
W _{pl2} [mm ³]		W _{pl3} [mn	า ³]	i₂[mm		i₃[mm]			i _t [mm]		
2.597e+005	5	4.776e+	+004 8.296		+001	2.2	73e+001	2	.887e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vK}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.3333e+003	Th	2.3333e+003	3.3333e-007	0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	-4.6667e+003	Th	-4.6667e+003	3.3334e-007	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-1.8626e-009	-1.8626e-009	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-4.6667e+006	Th	-4.6667e+006	3.3334e-004	-0.0000

vs

Cv Tv TvK	computed value target value target value kind (theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100/TH OW / OW	Ac	accepted value (a value which, on the basis of some argument, can be considered acceptable).
100(10 - C0) / C0	relative error perc	entage
Computational note		

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT011BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT011BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)





Problem description:

Simply supported beam with internal shear force

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT011BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT011B
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©

GEOMETRY & CONSTRAINTS											
Full Length	[mm]	Dx1 [mm]									Constraints
3000			2	2000			-		-		As shown
LOAD											
	Туре			1	Value			Po	int of applica	ation	
force c	oncentrat	ed		7.0	00e+0	003			Dx1		
									-		
									-		
									-		
MATERIAL										Fe360	
f _v [N/mm ²]	f _u [N/mı	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e+	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	ON										IPE200
A [mm ²]	J	$l_2[mm^4]$		J_3 [mm ⁴] J		J	[mm ⁴]	V	$V_2 [mm^3]$		W_3 [mm ³]
2.981e+003	3 2.0)51e+00	7	1.540e	1.540e+006		6.254e+004		051e+005	3	3.081e+004
W_{pl2} [mm ³]	W	_{pl3} [mm ³]		i ₂ [mm]		i₂[mm] i₂			i _t [mm]		
2.597e+005	6 4.7	776e+00)4	8.296e+001		2.2	73e+001	2.	887e+001		
OTHER DATA											

TARGET VALUES vs **COMPUTED VALUES**

Description	T_{v}	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.3333e+003	Th	2.3333e+003	-2.3300e-004	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	4.6667e+003	Th	4.6667e+003	2.3300e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	6.9849e-010	6.9849e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-9.3132e-010	-9.3132e-010	-0.0000

Cv	computed value
Tv	target value
TvK	target value kind (t

target value kind (theoretical, cross check, accepted).

Th

theoretical value cross check value (theoretical target value is not known, results obtained with a different

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable).

Ac 100(Tv - Cv) / Cv relative error percentage

Computational notes:

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

Cr





Problem description:

Simply supported beam with internal shear force (midpoint)

- 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:

Pictures 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:


TEST SCHEDULE CASTALIA_STAT012		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT012
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [ו [mm] Dx1 [mm]									C	constraints
3000			1	500			-		-		As shown
LOAD											
-	Гуре				Value			Р	oint of applica	ation	
NODA	L FORC	E		7.0)00e+0	003			Dx1		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm ²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	Ν									I	PE200
A [mm ²]		J₂[mm⁴]		J₃ [mr	n⁴]	J	t[mm⁴]		W ₂ [mm ³]	W	′₃[mm³]
2.981e+003	2.	051e+00	7	1.540e	+006	6.2	254e+004	2	2.051e+005	3.0)81e+004
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i ₂ [mi	m]	ig	₃[mm]		i _t [mm]		
2.597e+005	4.	776e+00	e+004 8.296e+00		+001	2.273e+001		2	2.887e+001		
OTHER DATA	OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.5000e+003	Th	3.5000e+003	-1.8190e-012	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	-3.5000e+003	Th	-3.5000e+003	1.8190e-012	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-5.2500e+006	Th	-5.2500e+006	-1.8626e-009	0.0000

vs

Cv Tv TvK	computed value target value target value kind	(theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100/7	Ac	accepted value (a value which, on the basis of some argument, can be considered acceptable).
100(1V - CV) / CV	relative error perc	entage
Computational note	NG.	

Computational notes:

Authors: Computed errors:

Ing. Marco Croci, Ing. Paolo Rugarli checksolvers.exe, by Castalia srl.



TEST SCHEDULE CASTALIA_STAT012BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT012BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)





Problem description:

Simply supported beam with internal shear force (midpoint)

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT012BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT012BI
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©

GEOMETRY & CONSTRAINTS											_ ٦
Full Length	ngth [mm] Dx1 [mm]									С	onstraints
3000			1	500			-		-	A	As shown
LOAD											
	Туре			`	Value			Po	int of applica	ation	
force of	concentrat	ed		7.0	00e+0	03			Dx1		
									-		
							-				
	-										
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.06	60e+005	3.000	De-001	1.200e-0)05			
CROSS-SECTIO	ON									IF	2200 YE200
A [mm ²]		J₂[mm⁴]		J₃[mr	n4]	J	J_{t} [mm ⁴]		I_2 [mm ³]	W	₃ [mm ³]
2.981e+003	3 2.	051e+00	7	1.540e	+006	6.2	54e+004	2.	051e+005	3.0	81e+004
W _{pl2} [mm ³]	W	′ _{pl3} [mm ³]		i₂[mı	m]	ia	₃ [mm]		i _t [mm]		
2.597e+005	5 4.	776e+00	e+004 8.296e+00		+001	2.273e+001		2.	887e+001		
OTHER DATA											

TARGET VALUES vs **COMPUTED VALUES**

Description	T_{v}	Т _{vК}	Cv	(C_v-T_v)	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.5000e+003	Th	3.5000e+003	0.0000e+000	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	3.5000e+003	Th	3.5000e+003	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-9.3132e-010	-9.3132e-010	-0.0000

Cv	computed value
Tv	target value
TvK	target value kind

. et value

target value kind (theoretical, cross check, accepted).

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

100(Tv - Cv) / Cv relative error percentage

Computational notes:

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





Problem description:

Simply supported beam with two equal 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:

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Note:



TEST SCHEDULE CASTALIA_STAT013		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT013
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©

GEOMETRY & CONSTRAINTS											
Full Length	[mm] Dx1 [mm					Dx2 [mm]				C	onstraints
3000			1	000			2000		-	1	As shown
LOAD											
	Туре			,	Value			Po	int of applica	ation	
NOD	AL FORC	E		7.0	00e+	003			Dx1		
NOD	AL FORC	E		7.0	00e+	003			Dx2		
									-		
	-										
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	1] E	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.06	60e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIO	DN									I	PE200
A [mm ²]		J₂[mm⁴]		J₃ [mr	m⁴]	J	t[mm⁴]	۷	V ₂ [mm ³]	W	′ ₃ [mm ³]
2.981e+003	2.	051e+0)07	1.540e	+006	6.2	54e+004	2.	051e+005	3.0)81e+004
W _{pl2} [mm ³]	W	/ _{pl3} [mm	າ ³]	i₂[mı	m]	ig	₃[mm]		i _t [mm]		
2.597e+005	4.	.776e+004 8.2		8.296e	+001	2.2	73e+001	73e+001 2.8			
OTHER DATA											

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	7.0000e+003	Th	7.0000e+003	0.0000e+000	0.0000
Shear T3, J extreme. Beam # 3. Load case # 1	7.0000e+003	Th	7.0000e+003	1.4552e-011	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-6.5193e-009	-6.5193e-009	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	-7.0000e+006	Th	-7.0000e+006	-9.3132e-009	0.0000

vs

Cv Tv	computed value target value	
IVK	target value kind (theoretical, cross check	, accepted).
	Th theoretical value	
	Cr cross check value (th program are used as	eoretical target value is not known, results obtained with a different target values).
	Ac accepted value (a va	ue which, on the basis of some argument, can be considered acceptable).
100(Tv - Cv) / Cv	relative error percentage	
O		

Computational notes:

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





Problem description:

Simply supported beam with two equal 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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT013BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT013BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	n [mm] Dx1 [mm]					Dx2 [mm]				C	onstraints
3000			1	000			2000		-	A	s shown
LOAD											
	Туре			,	Value			Po	int of applic	ation	
force of	concentrat	ed		7.0	00e+0	003			Dx1		
force of	concentrat	ed		7.0	00e+0	003			Dx2		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIO	ON									IF	'E200
A [mm ²]		J₂[mm⁴]		J₃ [mr	n⁴]	J	t[mm⁴]	۷	$V_2 [mm^3]$	W	₃ [mm ³]
2.981e+003	3 2.	051e+00	7	1.540e	+006	6.2	54e+004	2.	051e+005	3.0	81e+004
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i₂[mı	m]	ig	₃[mm]		i _t [mm]		
2.597e+005	5 4.	776e+00	4	8.296e+001 2.273e+001 2.887e+001							
OTHER DATA											

TARGET VALUES vs **COMPUTED VALUES**

Description	T_{v}	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	7.0000e+003	Th	7.0000e+003	-9.0949e-013	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	7.0000e+003	Th	7.0000e+003	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	1.8626e-009	1.8626e-009	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-9.3132e-010	-9.3132e-010	-0.0000

computed value target value	

target value kind (theoretical, cross check, accepted).

Th Cr

theoretical value cross check value (theoretical target value is not known, results obtained with a different

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac 100(Tv - Cv) / Cv relative error percentage

Computational notes:

Cv Tv TvK

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





Problem description:

Simply supported beam with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT014 SOLVING **BEAM PROBLEM** SOL.SAR.STAT014 FINITE ELEMENT CLEVER (SARGON ©) SOLVER

			GEC	METRY 8	s coi	NSTRAII	NTS					
Full Length	ength [mm]									С	onstraints	
3000				-			-		-	ŀ	As shown	
LOAD												
	Туре			,	Value)		Po	int of application	ation		
force	distribute	d		2.5	570e+	000			-			
									-			
									-			
									-			
MATERIAL											Fe360	
f _v [N/mm ²]	f _u [N/m	m²]	E [I	N/mm ²]		V	α					
2.350e+002	3.600e	+002	2.0	60e+005 3.000e-001			1.200e-	005				
CROSS-SECTIC	DN									I	PE200	
A [mm ²]		J ₂ [mm ⁴]		J₃[mi	m⁴]	J	t[mm ⁴]	\	V ₂ [mm ³]	W	₃ [mm³]	
2.981e+003	2.	051e+0	07	1.540e	+006	6.2	254e+004	2	051e+005	3.0	81e+004	
$W_{pl2} [mm^3]$	W	' _{pl3} [mm	3]	i₂[m	m]	i	₃ [mm]		i _t [mm]			
2.597e+005	2.597e+005 4.776e+004 8.296e+0				+001	2.2	273e+001	2	.887e+001			
OTHER DATA												

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.8550e+003	Th	3.8550e+003	-9.0949e-013	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	3.8550e+003	Th	3.8550e+003	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

vs

Cv Tv TvK	computed value target value target value kind (t	theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100(Tv – Cv) / Cv	Ac relative error perce	accepted value (a value which, on the basis of some argument, can be considered acceptable). entage
Computational note		

Computational notes:

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





Problem description:

Simply supported beam with two internal distributed constant loads

- 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:

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Note:



TEST SCHEDULE CASTALIA_STAT015		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT015
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

	GEOMETRY & CONSTRAINTS											
Full Length	[mm]	mm] Dx1 [mm]				Dx2 [mm]				(Constraints	
3000			1	000			2000		-		As shown	
LOAD												
	Туре			١	Value			Po	oint of application	ation		
force	distribute	d		2.5	70e+0	000			Left end-Dx	:1		
force	distribute	d		2.5	70e+0	000			Dx2-Right e	nd		
									-			
									-			
MATERIAL											Fe360	
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm ²]		V	α					
2.350e+002	3.600e	+002	2.06	60e+005	3.00	0e-001	1.200e-0	005				
CROSS-SECTIO	DN										PE200	
A [mm ²]		J₂[mm⁴]		J₃[mr	n4]	J	[mm ⁴]	1	W₂[mm ³]	۷	√ ₃ [mm³]	
2.981e+003	2.	051e+00)7	1.540e	+006	6.2	54e+004	2	.051e+005	3.	081e+004	
W _{pl2} [mm ³]	W	′ _{pl3} [mm ³]	i₂[mı	m]	ia	[mm]		i _t [mm]			
2.597e+005	4.	776e+00	e+004 8.296e+001 2.273e+001 2.887e+001				.887e+001					
OTHER DATA												

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	Т _{vК}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.5700e+003	Th	2.5700e+003	1.3642e-012	0.0000
Shear T3, J extreme. Beam # 3. Load case # 1	2.5700e+003	Th	2.5700e+003	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-1.2850e+006	Th	-1.2850e+006	4.6566e-010	-0.0000

vs

Cv Tv	computed value target value
IVK	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(Tv - Cv) / Cv	relative error percentage
Computational pate	

Computational notes:

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



TEST SCHEDULE CASTALIA_STAT015BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT015BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)
2.57 kN/ m 2.57 kN/ m	2.57 kN/ m	2.57 kN/ m
+2.57 KN	-2.57 KN	1.285 kN m

Problem description:

Simply supported beam with two internal distributed constant loads

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:

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Note:



TEST SCHEDULE
CASTALIA_STAT015BISSOLVINGBEAM PROBLEMFINITE ELEMENTSOLVER

SOL.SAR.STAT015BIS CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [mm] Dx1				1 [mm] [Dx2 [mm]				Constraints
3000			1	000			2000		-		As shown
LOAD											
	Туре	e		١	Value			Poi	nt of applic	ation	
force line	arly o	distributed		2.57 2.57	70e+00 70e+0	00- 00			Left end-D>	k 1	
force line	arly o	distributed		2.57 2.57	70e+00 70e+0	00- 00		[0x2-Right e	nd	
									-		
-											
MATERIAL											Fe360
f _v [N/mm ²]	f _u	[N/mm ²]	E [I	N/mm²]		V	α				
2.350e+002	3.6	600e+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	DN										IPE200
A [mm ²]		J₂[mm⁴]	J₃[mr	n ⁴]	J t	[mm ⁴]	N	I_{2} [mm ³]	V	V₃[mm³]
2.981e+003	;	2.051e+	007	1.540e	+006	6.2	54e+004	2.0	051e+005	3.	.081e+004
W _{pl2} [mm ³]		W _{pl3} [mn	W _{pl3} [mm ³] i ₂ [mm]			i ₃	i ₃ [mm] i _t [mm]		t[mm]		
2.597e+005	,	4.776e+	004	4 8.296e+001 2.2			73e+001	2.8	387e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{ν}	T_{vK}	Cv	(C_v-T_v)	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.5700e+003	Th	2.5700e+003	-2.5700e-004	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	2.5700e+003	Th	2.5700e+003	-2.5700e-004	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-1.1642e-010	-1.1642e-010	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-2.3283e-010	-2.3283e-010	-0.0000

vs

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(Tv – Cv) / Cv	relative error perc	entage

Computational notes:

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





Problem description:

Simply supported beam with internal distributed constant load

- 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:

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Note:



TEST SCHEDULE CASTALIA_STAT016		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT016
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS										7	
Full Length	Full Length [mm] Dx ⁻			1 [mm] D>			Dx2 [mm]			Co	onstraints
3000			1	000			2000		-	A	s shown
LOAD											
	Туре				Value			Po	oint of applica	ation	
force	distribute	d		2.5	570e+	000			Dx1-Dx2		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIO	N									IP	E200
A [mm ²]		J₂[mm⁴]		J₃ [mm⁴]		J	t[mm⁴]	1	W ₂ [mm ³]	W ₃	₃ [mm ³]
2.981e+003	2.	051e+00	7	1.540e	+006	6.2	6.254e+004		.051e+005	3.0	81e+004
W _{pl2} [mm ³]	N	W _{pl3} [mm ³]		i₂[mı	m]	i₃[mm]			i _t [mm]		
2.597e+005	2.597e+005 4.776e+004 8.296		8.296e	+001	1 2.273e+001 2		2	.887e+001			
OTHER DATA	OTHER DATA										

TARGET	VALUES
--------	--------

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.2850e+003	Th	1.2850e+003	0.0000e+000	0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	1.2850e+003	Th	1.2850e+003	-9.0949e-013	-0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	1.2850e+006	Th	1.2850e+006	-2.0955e-009	-0.0000
Bending M2, J extreme. Beam # 3. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000

vs

Cv Tv TvK	computed value target value target value kind ((theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100/Ter 0:) / 0:	Ac	accepted value (a value which, on the basis of some argument, can be considered acceptable).
100(10 – CV) / CV	relative error perc	entage
Computational note	NC '	

Computational notes:

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



TEST SCHEDULE CASTALIA_STAT016BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT016BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)
2.57 kN/2tā7 kN/ m → ● +1.285 kN1.285 kN	2.57	(N/2⊡57 kN/m

Problem description:

Simply supported beam with internal distributed constant load

-1.285 kN

- **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

1.60625 kŊ⁄m

Editorial note:

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Note:



TEST SCHEDULE CASTALIA_STAT016BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT016BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	Full Length [mm] Dx1 [mm]					Dx2 [mm]				C	onstraints
3000			1	000			2000		-	Α	s shown
LOAD]										
	Туре			,	Value			Po	int of applica	ation	
force line	arly di	istributed		2.57 2.5	70e+00 70e+00)0-)0			Dx1-Dx2		
									-		
									-		
	-										
MATERIAL											Fe360
f _y [N/mm ²]	f _u [N	N/mm²]	E [I	N/mm²]		v	α				
2.350e+002	3.60	00e+002	2.0	60e+005	3.00	0e-001	1.200e-0	05			
CROSS-SECTIO	ON									IF	'E200
A [mm ²]		J₂[mm ⁴]	J₃[mı	m⁴]	J	t[mm⁴]	٧	/ ₂ [mm ³]	W;	₃[mm³]
2.981e+003	3	2.051e+	007	1.540e	+006	6.2	54e+004	2.	051e+005	3.0	81e+004
W _{pl2} [mm ³]		W _{pl3} [mn	າ"]	i ₂ [m	m]	ig	3 [mm]		i _t [mm]		
2.597e+005	5	4.776e+	004	8.296e	+001	2.2	73e+001	2.	887e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.2850e+003	Th	1.2850e+003	2.5700e-004	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	1.2850e+003	Th	1.2850e+003	2.5700e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	1.1642e-010	1.1642e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-3.4925e-010	-3.4925e-010	-0.0000

vs

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(Tv - Cv) / Cv relative error percentage

Computational notes:

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





Problem description:

Simply supported beam with internal distributed constant load

- 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 gualità, travi, misura di errore

Editorial note:

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Note:



TEST SCHEDULE CASTALIA_STAT017		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT017
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAIN	ITS				
Full Length [mm]		Dx ⁻	1 [mm]						С	onstraints
3000			2	2000			-		-	A	\s shown
LOAD											
-	Гуре			,	Value			Р	oint of applica	ation	
force of	distribute	d		2.5	570e+	000			Left end-Dx	:1	
									-		
									-		
			-								
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIO	Ν									IF	PE200
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm⁴]		W ₂ [mm ³]	W	₃ [mm³]
2.981e+003	2.	051e+00)7	1.540e	+006	6.2	254e+004	2	2.051e+005	3.0	81e+004
W _{pl2} [mm ³]	W	′ _{pl3} [mm ³]	i ₂ [m	m]	i;	₃[mm]		i _t [mm]		
2.597e+005	4.	776e+00)4	8.2966	+001	2.2	73e+001	2	2.887e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.4267e+003	Th	3.4267e+003	-3.3333e-007	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	-1.7133e+003	Th	-1.7133e+003	-3.3334e-007	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-2.3283e-010	-2.3283e-010	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-1.7133e+006	Th	-1.7133e+006	-3.3333e-004	0.0000

vs

Cv Tv	computed value target value	
IVK	target value kind (the	oretical, cross check, accepted).
	Th th Cr c	neoretical value cross check value (theoretical target value is not known, results obtained with a different
	p	rogram are used as target values).
	Ac a	iccepted value (a value which, on the basis of some argument, can be considered acceptable).
100(Tv - Cv) / Cv	relative error percenta	age
O		

Computational notes:

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





Problem description:

Simply supported beam with internal distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT017BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT017BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8	CON	STRAIN	ITS				
Full Length	Length [mm] Dx1 [mm]									Co	onstraints
3000			2	2000			-		-	A	s shown
LOAD]										
	Туре	9		,	Value			Poir	nt of applica	tion	
force line	early o	distributed		2.57 2.5	70e+00 70e+0)0- 00		L	.eft end-Dx ⁻	1	
									-		
									-		
MATERIAL											Fe360
f _y [N/mm ²]	f _u	[N/mm ²]	E [N/mm²]		V	α				
2.350e+002	3.6	600e+002	2.0	60e+005	3.00	0e-001	1.200e-0	05			
CROSS-SECTIO	ON									IP	E200
A [mm ²]		J₂[mm'	¹]	J₃[mı	n⁴]	J	t[mm ⁴]	W	₂ [mm ³]	Wa	₃ [mm ³]
2.981e+003	3	2.051e+	007	1.540e	+006	6.2	54e+004	2.0	51e+005	3.0	81e+004
W _{pl2} [mm ³]		W _{pl3} [mr	n ³]	i ₂ [m	m]	ia	3 [mm]	i,	[mm]		
2.597e+00	5	4.776e+	004	8.2966	96e+001 2.2		73e+001	2.8	87e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.4267e+003	Th	3.4267e+003	8.5333e-005	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	1.7133e+003	Th	1.7133e+003	1.7167e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

vs

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(Tv - Cv) / Cv relative error percentage

Computational notes:

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





Problem description:

Simply supported beam with two internal distributed constant loads

- 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:

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Note:



TEST SCHEDULE CASTALIA_STAT018		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT018
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [mm] Dx1				1 [mm]			Dx2 [mm]			C	Constraints
3000			1	000			2000		-	1	As shown
LOAD											
	Туре			,	Value			Po	oint of application	ation	
force	distribut	əd		2.5	570e+0	000			Left end-Dx	1	
force	distribut	ed		2.5	570e+0	000			Dx2-Right er	nd	
									-		
									-		
MATERIAL	MATERIAL									Fe360	
f _v [N/mm ²]	f _u [N/n	וm²]	E [l	N/mm ²]		V	α				
2.350e+002	3.600	+002	2.0	60e+005	+005 3.000e-		1.200e-005				
CROSS-SECTIO	ON									I	PE200
A [mm ²]		J ₂ [mm ⁴]		J_3 [mm ⁴]		J	[mm ⁴]	V	N ₂ [mm ³]	W	/ ₃ [mm ³]
2.981e+003	3 2	.051e+0	07	1.540e	+006	6.2	54e+004	2.	.051e+005	3.0)81e+004
W _{pl2} [mm ³]	W_{pl2} [mm ³] W_{pl3} [mm ³]		3]	i₂[mı	m]	ig	[mm]		i _t [mm]		
2.597e+005 4.776e+004		04	8.296e+001		2.2	2.273e+001		2.887e+001			
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	T_{vK}	Cv	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 3. Load case # 1	0.0000e+000	Th	1.8190e-012	1.8190e-012	0.0000
Shear T3, J extreme. Beam # 5. Load case # 1	2.0560e+003	Th	2.0560e+003	-5.8208e-011	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-4.1120e+005	Th	-4.1120e+005	1.1176e-008	-0.0000
Bending M2, I extreme. Beam # 3. Load case # 1	1.2336e+006	Th	1.2336e+006	-1.6997e-008	-0.0000

vs

Cv Tv	computed value target value
IVK	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(Tv - Cv) / Cv	relative error percentage
O	

Computational notes:

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





Problem description:

Simply supported beam with two internal distributed constant loads

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:

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Note:



 TEST SCHEDULE

 CASTALIA_STAT018BIS

 SOLVING
 BEAM PROBLEM

 FINITE ELEMENT
 SOLVER
 CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											Γ.
Full Length	1 [mm]		Dx2 [mm]				С	onstraints			
3000	000			2000		-	A	s shown			
LOAD											
	Туре			,	Value			Poir	nt of applic	ation	
force line	arly dis	tributed		2.570e+000- 2.570e+000				Left end-Dx1			
force line	arly dis	tributed		2.57 2.5	70e+00 70e+0)0-)0		Dx2-Right end			
						-					
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N	/mm²]	E [I	N/mm²]		ν α					
2.350e+002	3.60	0e+002	2.0	60e+005	3.00	0e-001	1.200e-(005			
CROSS-SECTIO	DN									IF	°E200
A [mm ²]		J₂[mm⁴]	J₃ [mr	n⁴]	J _t	[mm ⁴]	W	₂ [mm³]	W	₃[mm³]
2.981e+003	;	2.051e+	007	1.540e	+006	6.2	54e+004	2.0	51e+005	3.0	81e+004
W _{pl2} [mm ³]	W pl2 [mm ³] W pl2		n ³]	i₂[mı	m]	i ₃	[mm]	i,	[mm]		
2.597e+005 4.776e+004			8.296e+001 2.2			73e+001	2.8	87e+001			
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.0560e+003	Th	2.0560e+003	-2.9812e-004	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	2.0560e+003	Th	2.0560e+003	-4.9858e-004	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	1.1642e-010	1.1642e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-3.4925e-010	-3.4925e-010	-0.0000

vs

Cv	computed value	
Tv	target value	
TvK	target value kind	(theoretical, cross check, accepted).
	Ŭ 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(Tv - Cv) / Cv	relative error per	centage

Computational notes:

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





Problem description:

Simply supported beam with distributed linear load

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:

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Note:



TEST SCHEDULE CASTALIA STAT019

SOLVING	BEAM PROBLEM	SOL.SAR.STAT019
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEO	OMETRY 8		STRAIN	NTS				
Full Length	[mm]								C	onstraints	
3000				-			-		-	A	s shown
LOAD]										
	Туре				Value			F	Point of application	ation	
force line	arly dis	stributed		1.2 2.5	1.280e+000- 2.570e+000			_			
						-					
					-						
	-										
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N	l/mm²]	E	N/mm ²]		v	α				
2.350e+002	3.60	0e+002	2.0)60e+005	3.000	De-001	1.200e-0	005			
CROSS-SECTIO	ON									IF	'E200
A [mm ²]		J₂[mm'	¹]	J₃[mı	m⁴]	J	t[mm ⁴]		W ₂ [mm ³]	W ₃	₃[mm³]
2.981e+003		2.051e+	007	1.540e	+006	6.2	254e+004		2.051e+005	3.0	81e+004
W _{pl2} [mm ³]		W _{pl3} [mr	n³]	i ₂ [m	i₂[mm]		₃[mm]		i _t [mm]		
2.597e+005		4.776e+	004	8.296e	+001 2		?73e+001		2.887e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.5650e+003	Th	2.5650e+003	0.0000e+000	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	3.2100e+003	Th	3.2100e+003	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	4.6566e-010	4.6566e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

vs

Cv	computed value
Tv	target value
TvK	target value kind

target value kind (theoretical, cross check, accepted).

Th Cr

- theoretical value cross check value (theoretical target value is not known, results obtained with a different

Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). 100(Tv - Cv) / Cv relative error percentage

Computational notes:

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





Problem description:

Simply supported beam with two distributed linear loads

- 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:

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Note:



TEST SCHEDULE CASTALIA_STAT020		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT020
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©

			GEC	METRY 8		STRAIN	ITS				
Full Length	[mm]		Dx1	1 [mm]						С	onstraints
3000			1	500			-		-	ļ	As shown
LOAD											
	Туре			,	Value			P	pint of application	ation	
force line	arly di	stributed		0.000e+000- 2.570e+000			Left end-Dx1				
force line	arly di	stributed		2.570e+000- 0.000e+000			Dx1-Right end				
									-		
MATERIAL											Fe360
f _y [N/mm ²]	f _u [N	J/mm²]	E [I	N/mm²]	١	v	α				
2.350e+002	3.60	00e+002	2.0	60e+005	3.000	De-001	01 1.200e-005				
CROSS-SECTIO	DN									II	PE200
A [mm ²]		J₂[mm⁴	m^4] J_3 [mm ⁴]		J _t	J_t [mm ⁴]		W₂[mm ³]	W	3 [mm ³]	
2.981e+003		2.051e+	007	1.540e	+006	6.2	54e+004	2	.051e+005	3.0	81e+004
W _{pl2} [mm ³]		W _{pl3} [mn	າ ³]	i₂[mı	m]	i ₃	[mm]		i _t [mm]		
2.597e+005		4.776e+	004	8.296e	+001	2.2	73e+001	2	.887e+001		
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.9275e+003	Th	1.9275e+003	-1.1369e-012	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	6.8212e-013	6.8212e-013	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-1.9275e+006	Th	-1.9275e+006	9.3132e-010	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-9.8953e-010	-9.8953e-010	-0.0000

Cv	computed value
Tv	target value
TvK	target value kind (theoretical, cross check, accepted)
	Th theoretical value

- cross check value (theoretical target value is not known, results obtained with a different

 $\frac{1}{100(Tv - Cv) / Cv}$ relative error percentage

Computational notes:

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

Cr



TEST SCHEDULE CASTALIA_STAT020BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT020BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)
2.57 kN/ m		.57 KN/ m
+1.9275 KN	1.9275 KN	3275 KN m

Problem description:

Simply supported beam with two distributed linear loads

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:

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Note:



TEST SCHEDULE CASTALIA_STAT020BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT020BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		G	EOMETRY &		STRAIN	ITS				Γ.
Full Length	[mm]		Dx1 [mm]						C	Constraints
3000			1500			-		-	1	As shown
LOAD										
	Туре			Value			Poi	nt of applica	ation	
force line	arly distril	outed	0.00 2.5	0.000e+000- 2.570e+000			Left end-Dx1			
force line	arly distril	outed	2.57 0.0	2.570e+000- 0.000e+000		Dx1-Right end				
							-			
								-		
MATERIAL										Fe360
f _v [N/mm ²]	f _u [N/m	m²] E	E [N/mm²]		V	α				
2.350e+002	3.600e	+002 2	.060e+005	3.000	0e-001	1.200e-005				
CROSS-SECTIO	N								I	PE200
A [mm ²]		J ₂ [mm ⁴]	J₃[m	m ⁴]	J _t	[mm⁴]	W	2 [mm ³]	W	/ ₃ [mm ³]
2.981e+003	2.	051e+007	1.5406	+006	6.2	54e+004	2.0)51e+005	3.0)81e+004
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i₂[m	m]	i ₃	[mm]	i	t [mm]		
2.597e+005	4.	776e+004	8.2966	+001	2.2	73e+001	2.8	87e+001		
OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.9275e+003	Th	1.9275e+003	-1.3642e-012	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	1.9275e+003	Th	1.9275e+003	4.0927e-012	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	2.3283e-010	2.3283e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

vs

IVK	Th Cr	theoretical, cross check, accepted). theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100(Tv – Cv) / Cv	Ac relative error perc	accepted value (a value which, on the basis of some argument, can be considered acceptable). entage

Computational notes:

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





Problem description:

Simply supported beam with two internal distributed linear loads

- 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:

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Note:



TEST SCHEDULE CASTALIA STAT021

SOLVING	BEAM PROBLEM	SOL SAR STAT021
OOLVING	DEAMITTIODEEM	50E.5AH.5TAT021
FINITE ELEMENT	SOLVER	CLEVER (SARGON \bigcirc)

GEOMETRY & CONSTRAINTS											
Full Length	[mm]	וm] Dx1 [mm]				Dx2 [mm]			Dx3 [mr	n] C	onstraints
3000			1	000	000		1500	1500		A	s shown
LOAD											
	Туре			,	Value			Po	int of applic	ation	
force line	arly dist	ributed		0.00 2.5)0e+0 70e+0	00- 000			Dx1-Dx2		
force line	arly dist	ributed		2.57 0.00	70e+0 00e+0	00- 000			Dx2-Dx3		
									-		
-											
MATERIAL											Fe360
f _y [N/mm ²]	f _u [N/ı	mm²] E [l		N/mm²]		V	α				
2.350e+002	3.600	e+002	2.0	60e+005 3.000e-		00e-001	1.200e-	005			
CROSS-SECTIO	ON									IF	°E200
A [mm ²]		J ₂ [mm	1]	J ₃ [mm ⁴]		J	t[mm⁴]	V	V_2 [mm ³]	W	₃[mm³]
2.981e+003	3 2	2.051e+	007	1.540e+00		6.2	54e+004	2.	051e+005	3.0	81e+004
W _{pl2} [mm ³]	1	N _{pl3} [mr	nm ³] i ₂ [mm]		m]	ig	₃[mm]		i _t [mm]		
2.597e+005	5 4	l.776e+	004	8.296e+001		2.2	73e+001	2.	887e+001		
OTHER DATA											

TARGET VALUES vs **COMPUTED VALUES**

Description	T_{ν}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 2. Load case # 1	6.4250e+002	Th	6.4250e+002	-5.5707e-012	-0.0000
Shear T3, I extreme. Beam # 4. Load case # 1	0.0000e+000	Th	-1.8190e-012	-1.8190e-012	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-6.4250e+005	Th	-6.4250e+005	4.1910e-009	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	-8.5667e+005	Th	-8.5667e+005	3.3342e-005	-0.0000

Cv	computed value
Tv	target value
TvK	target value kind (theoretical, cross chec
	The theoretical value

- k, accepted). Τh theoretical value
- Cr
 - cross check value (theoretical target value is not known, results obtained with a different

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac

100(Tv – Cv) / Cv relative error percentage

Computational notes:

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





Problem description:

Simply supported beam with two internal distributed linear loads

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:

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Note:



TEST SCHEDULE
CASTALIA_STAT021BISSOLVINGBEAM PROBLEMSOL.SAR.STAT021BISFINITE ELEMENTSOLVERCLEVER (SARGON ©)

		(GEC	METRY 8	CON	STRAIN	ITS				
Full Length	[mm]	mm] Dx1 [mm]				Dx2 [mm] Dx2 [mm]				n] (Constraints
3000			1	000			1500		2000		As shown
LOAD											
	Туре				Value			Poi	int of applica	ation	
force line	arly distri	outed		0.000e+000- 2.570e+000					Dx1-Dx2		
force line	arly distri	outed		2.57 0.00	70e+00 00e+00)0- 00			Dx2-Dx3		
									-		
					-						
MATERIAL		Fe							Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	DN										PE200
A [mm ²]		$J_2[mm^4]$		J₃ [mı	J₃[mm⁴]		t[mm⁴]	W	/₂[mm ³]	V	/ ₃[mm ³]
2.981e+003	2.	051e+00	7	1.540e+000		6.2	54e+004	2.0	051e+005	3.	081e+004
W _{pl2} [mm ³]	W	_{[pl3} [mm ³]		i ₂ [mm]		ia	3 [mm]	i	i _t [mm]		
2.597e+005	4.	776e+00	4	8.296e+00		2.273e+001		2.8	387e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	T_{vK}	Cv	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	6.4250e+002	Th	6.4250e+002	1.2850e-004	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	6.4250e+002	Th	6.4250e+002	1.2850e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	1.7462e-010	1.7462e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-1.1642e-010	-1.1642e-010	-0.0000

vs

Cv	computed value	
Tv	target value	
TvK	target value kind	(theoretical, cross check, accepted).
	Ŭ 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(Tv – Cv) / Cv	relative error perc	entage

Computational notes:

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







Problem description:

Simply supported beam with two distributed linear loads

- 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:

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Note:


TEST SCHEDULE CASTALIA STAT022

SOLVING	BEAM PROBLEM	SOL.SAR.STAT022
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	Full Length [mm] Dx1 [mm]									Constraints	
3000			1	500			-		-		As shown
LOAD											
	Туре				Value			Po	int of applic	ation	
force line	arly distrik	outed		2.57 0.00	70e+0 00e+0	00- 000			Left end-D>	< 1	
force line	arly distrik	outed		0.00 2.5)0e+0 70e+0	00- 000		I	Dx1-Right e	nd	
									-		
MATERIAL											Fe360
f _y [N/mm ²]	f _u [N/m	m²]	E [I	N/mm²]	J/mm ²] v						
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIC	N										IPE200
A [mm ²]		J₂[mm⁴]	J₃ [mr	m⁴]	J	t[mm⁴]	۷	I_2 [mm ³]	\	N_3 [mm ³]
2.981e+003	2.	051e+	007	1.540e	1.540e+006 6.25		254e+004	2.	051e+005	3	.081e+004
W _{pl2} [mm ³]	W	_{pl3} [mn	า ³]	i ₂ [mi	i ₂ [mm] i ₃				i _t [mm]		
2.597e+005	4.	776e+	004	8.296e+001 2.27		73e+001	2.	887e+001			
OTHER DATA	OTHER DATA										

TARGET VALUES vs **COMPUTED VALUES**

Description	T_{v}	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.9275e+003	Th	1.9275e+003	-4.5475e-013	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-9.0949e-013	-9.0949e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	6.4028e-010	6.4028e-010	0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	9.6375e+005	Th	9.6375e+005	1.1642e-009	0.0000

Cv	computed value
Tv	target value
TvK	target value kind (theoretical, cros
	Th theoretical va

s check, accepted).

theoretical value Cr

- cross check value (theoretical target value is not known, results obtained with a different

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac

100(Tv – Cv) / Cv relative error percentage

Computational notes:

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



TEST SCHEDULE CASTALIA_STAT022BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT022BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Simply supported beam with two distributed linear loads

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:

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Note:



TEST SCHEDULE CASTALIA_STAT022BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT022BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS									Π.	
Full Length	[mm]	D)x1 [mm]						(Constraints
3000			1500			-		-		As shown
LOAD										
	Туре			Value			Poi	nt of applica	ation	
force line	arly distrib	outed	2.57 0.0	70e+00 00e+0	00- 00			_eft end-Dx	:1	
force line	arly distrik	outed	0.00 2.5	00e+00 70e+0	00- 00	Dx2-Right end				
			-							
								-		
MATERIAL										Fe360
f _v [N/mm ²]	f _u [N/m	m²] E	[N/mm ²]		V	α				
2.350e+002	3.600e-	+002 2	.060e+005	3.00	0e-001	1.200e-(005			
CROSS-SECTIO	N									PE200
A [mm ²]		l₂[mm⁴]	J₃[m	m⁴]	J t	[mm⁴]	W	2 [mm ³]	٧	√ ₃ [mm ³]
2.981e+003	2.	051e+007	1.540€	+006	6.254e+004 2.051		51e+005	3.	081e+004	
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [m	m]	i ₃ [mm] i _t [mm]					
2.597e+005	4.	776e+004	8.2966	8.296e+001 2.273e+001 2.887e+001						
OTHER DATA	OTHER DATA									

TARGET VALUES

COMPUTED VALUES

Description	T_{ν}	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.9275e+003	Th	1.9275e+003	0.0000e+000	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	1.9275e+003	Th	1.9275e+003	-9.0949e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	5.8208e-010	5.8208e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000

vs

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

Computational notes:

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





Problem description:

Simply supported beam with distributed variable load

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

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Note:



TEST SCHEDULE CASTALIA_STAT023

SOLVING	BEAM PROBLEM	SOL.SAR.STAT023
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	[mm]		Dx	1 [mm]		Dx2 [mm]				(Constraints
3000				1000			2000		-		As shown
LOAD											
	Туре				Value			Poi	nt of applic	ation	
force linearly distributed				0.000e+000- 2.570e+000				Left end-Dx1			
force linearly distributed				2.570e+000- 2.570e+000					Dx1-Dx2		
force linearly distributed			2.570e+000- 0.000e+000		Dx2-Right end						
-											
MATERIAL											Fe360
f _y [N/mm ²]	f _u [N/m	ım²]	E [N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-005				
CROSS-SECTIO	ON										PE200
A [mm ²]		J₂[mm'	⁴]	J₃[mı	m⁴]	J _t	[mm ⁴]	W	2 [mm ³]	۷	/ ₃[mm³]
2.981e+003	3 2	.051e+	007	1.540e	+006	6.2	54e+004	2.0	51e+005	3.	081e+004
$W_{pl2} [mm^3]$	٧	l _{pl3} [mr	n ³]	i ₂ [m	m]	i ₃	[mm]	i	_t [mm]		
2.597e+005	5 4	.776e+	004	8.2966	8.296e+001 2.27			2.8	87e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 2. Load case # 1	1.2850e+003	Th	1.2850e+003	6.3665e-012	0.0000
Shear T3, J extreme. Beam # 3. Load case # 1	2.5700e+003	Th	2.5700e+003	4.0927e-012	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	3.3469e-010	3.3469e-010	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	-2.1417e+006	Th	-2.1417e+006	3.3333e-004	-0.0000

vs

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(Tv - Cv) / Cv relative error percentage

Computational notes:

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



TEST SCHEDULE CASTALIA_STAT023BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT023BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)
2.57 KN/ m 2.57 KN/ m		/ m 2.57 kN/ m
+2.57 KN	-2.57 KN -2.4	6292 KN 19

Problem description:

Simply supported beam with distributed variable load

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

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Note:



TEST SCHEDULE CASTALIA_STAT023BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT023BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [mm] Dx1 [mm]					[Dx2 [mm]			С	onstraints
3000			1	000			2000		-	ŀ	As shown
LOAD											
1	Гуре			,	Value			Poi	nt of applica	ation	
force linearly distributed				0.000e+000- 2.570e+000			Left end-Dx1				
force linearly distributed				2.570e+000- 2.570e+000					Dx1-Dx2		
force linearly distributed				2.570e+000- 0.000e+000				Dx2-Right end			
-											
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/mr	n²]	E [I	N/mm²]	v		α				
2.350e+002	3.600e+	-002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	Ν									IF	PE200
A [mm ²]	J	₂ [mm ⁴]		J₃[mı	m⁴]	J _t	[mm ⁴]	W	2 [mm ³]	W	₃ [mm ³]
2.981e+003	2.0)51e+0	07	1.540e	+006	6.2	54e+004	2.0	51e+005	3.0	81e+004
$W_{pl2} [mm^3]$	W	_{pl3} [mm ^č	·]	i₂[m	m]	i ₃	[mm]	i	_t [mm]		
2.597e+005	4.7	776e+0	04	8.296e	8.296e+001 2.27		73e+001	2.8	87e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{ν}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.5700e+003	Th	2.5700e+003	1.2850e-004	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	2.5700e+003	Th	2.5700e+003	1.2850e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-2.3283e-010	-2.3283e-010	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-9.3132e-010	-9.3132e-010	-0.0000

vs

Cv Tv TvK

computed value target value

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(Tv - Cv) / Cv relative error percentage

Computational notes:

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





Problem description:

Simply supported beam with distributed linear load

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT024		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT024
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

Full Length [mm] Constraint 3000 - - As shown LOAD Type Value Point of application 0.000e+000- 0.000e+000- 0.000e+000- 0.000e+000-			GEOMETRY	& CON	STRAIN	ITS]
3000 - - As shown LOAD	Full Length [m	nm]							Co	onstraints
LOAD Type Value Point of application 0.000e+000- 0.000e+000-	3000		-			-		-	A	s shown
Type Value Point of application 0.000e+000-	LOAD									
0.000e+000-	Ту	уре		Value			Pc	oint of applica	tion	
force linearly distributed 2.570e+000 -	force linearl	0. 2.	000e+0 570e+0	00- 00			-			
-								-		
-								-		
-								-		
MATERIAL Fe3	MATERIAL									Fe360
$f_v [N/mm^2]$ $f_u [N/mm^2]$ $E [N/mm^2]$ v α	f _v [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	2.350e+002	3.600e+002	2.060e+005	3.00	0e-001	1.200e-0	05			
CROSS-SECTION IPE200	CROSS-SECTION	N							IP	E200
A $[mm^2]$ J ₂ $[mm^4]$ J ₃ $[mm^4]$ J _t $[mm^4]$ W ₂ $[mm^3]$ W ₃ $[mm^3]$	A [mm ²]	J₂[mm ⁴]] J ₃ [n	າm⁴]	J	[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	2.981e+003	2.051e+0	007 1.540	e+006	6.2	54e+004	2.	051e+005	3.08	31e+004
W_{pl2} [mm ³] W_{pl3} [mm ³] I_{2} [mm] I_{3} [mm] I_{t} [mm]	W _{pl2} [mm ³]	W _{pl3} [mm	າ ³] i ₂ [n	าm]	ig	[mm]		it[mm]		
2.597e+005 4.776e+004 8.296e+001 2.273e+001 2.887e+001	2.597e+005	8.296	8.296e+001		273e+001 2.		887e+001			
OTHER DATA	OTHER DATA									

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.2850e+003	Th	1.2850e+003	0.0000e+000	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	2.5700e+003	Th	2.5700e+003	-9.0949e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	2.3283e-010	2.3283e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-2.3283e-010	-2.3283e-010	-0.0000

vs

Cv	computed value
Tv	target value
TvK	target value kind

arget value

target value kind (theoretical, cross check, accepted). Th

Cr

theoretical value cross check value (theoretical target value is not known, results obtained with a different Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). 100(Tv - Cv) / Cv relative error percentage

Computational notes:

Authors: Computed errors:





Problem description:

Simply supported beam with two 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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT025		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT025
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [mm]	[Dx1 [mm]			Dx2 [mm]				onstraints	
3000		1000				2000		-		As shown	
LOAD											
-	Гуре			Valu	е		Po	int of applic	ation		
NODA	L FORC	E		7.000e	+003			Dx1			
NODA	L FORC	E		7.000e	+003			Dx2			
								-			
	-										
MATERIAL										Fe360	
f _v [N/mm ²]	f _u [N/m	m²] [E [N/mm ²]	V	α					
2.350e+002	3.600e-	+002 2	2.060e+0	05 3.0	000e-001	1.200e-	005				
CROSS-SECTIO	Ν								I	PE200	
A [mm ²]		J ₂ [mm ⁴]	Ja	₃[mm⁴]	J	J _↑ [mm ⁴]		V ₂ [mm ³]	W	′ ₃ [mm ³]	
2.981e+003	2.0	051e+007	' 1.5	40e+00	6 6.2	254e+004	2.	051e+005	3.0)81e+004	
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i _z	2 [mm]	i	₃[mm]		i _t [mm]			
2.597e+005	4.	776e+004	. 8.2	8.296e+001		2.273e+001		2.887e+001			
OTHER DATA											

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.3333e+003	Th	2.3333e+003	3.3333e-007	0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	4.6667e+003	Th	4.6667e+003	-3.3333e-007	-0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	2.3333e+006	Th	2.3333e+006	3.3333e-004	0.0000
Bending M2, J extreme. Beam # 3. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage
Computational note	

Computational notes:

Authors: Computed errors:





Problem description:

Simply supported beam with two 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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT025BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT025BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©

GEOMETRY & CONSTRAINTS												
Full Length	[mm]	[Dx1	[mm]		Dx2 [mm]				Co	nstraints	
3000	-			000			2000		-	As	s shown	
LOAD												
	Туре			١	Value			Po	int of applica	ation		
force of	concentrat	ed		7.0	00e+0	003			Dx1			
force of	concentrat	ed		7.0	00e+0	003			Dx2			
									-			
	-											
MATERIAL										Fe360		
f _v [N/mm ²]	f _u [N/m	m²] I	E [N	l/mm²]		V	α					
2.350e+002	3.600e-	+002 2	2.06	0e+005	3.00	0e-001	1.200e-0)05				
CROSS-SECTIO	ON									IP	E200	
A [mm ²]		l₂[mm ⁴]		J₃[mr	n⁴]	J	t [mm⁴] \		V₂[mm ³]	W ₃	[mm ³]	
2.981e+003	3 2.0	051e+007	7	1.540e	+006	6.2	54e+004	54e+004 2.0		3.08	31e+004	
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	₁₃ [mm ³] i ₂ [mn		m]	ig	₃[mm]		i _t [mm]			
2.597e+005	5 4.	776e+004	L I	8.296e+001		2.273e+001		2.887e+001				
OTHER DATA	OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.3333e+003	Th	2.3333e+003	4.6700e-004	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	-2.3333e+003	Th	-2.3333e+003	-4.6700e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	2.3283e-010	2.3283e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000

vs

Cv	computed value
Tv	target value
TvK	target value kind

target value kind (theoretical, cross check, accepted).

theoretical value

Th Cr

cross check value (theoretical target value is not known, results obtained with a different program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable).

Ac

100(Tv - Cv) / Cv relative error percentage

Computational notes:

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





Problem description:

Simply supported beam with internal bending moment

- **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:

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Note:



TEST SCHEDULE CASTALIA_STAT026		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT026
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	[mm]		Dx ⁻	1 [mm]						С	onstraints
3000			1	000			-		-	ŀ	As shown
LOAD											
	Type Value Point of applicatio							ation			
NODA	L MOM	ENT		2.0	00e+00)7			Dx1		
-											
									-		
	-										
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N∕	mm²]	E [N/mm ²] <i>v</i>		α					
2.350e+002	3.600	e+002	2.0	60e+005	3.000	e-001	1.200e-0	05			
CROSS-SECTIO	ON									IF	PE200
A [mm ²]		J₂[mm'	¹]	J₃ [mi	m⁴]	J	[mm⁴]		W ₂ [mm ³]	W	₃ [mm ³]
2.981e+003	3	2.051e+	007	1.540e	+006	6.2	54e+004	2	2.051e+005	3.0	81e+004
W _{pl2} [mm ³]		W _{pl3} [mr	n ³]	i ₂ [m	m]	ia	_a [mm]		i _t [mm]		
2.597e+005	5	4.776e+	004	8.296e+00		2.2	73e+001	2.887e+001			
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, J extreme. Beam # 1. Load case # 1	6.6667e+003	Th	6.6667e+003	-3.3332e-007	-0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	6.6667e+003	Th	6.6667e+003	-3.3334e-007	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	6.6667e+006	Th	6.6667e+006	-3.3332e-004	-0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	1.3333e+007	Th	1.3333e+007	3.3333e-003	0.0000

vs

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

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT026BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT026BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)
		×



Problem description:

Simply supported beam with internal bending moment

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT026BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT026BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

	GEOMETRY & CONSTRAINTS										
Full Length	[mm]		Dx1	1 [mm]							Constraints
3000		1000					-		-		As shown
LOAD											
	Туре			1	Value			Po	int of application	ation	
moment	concentra	ated		2.0	00e+0	07			Dx1		
									-		
									-		
	-										
MATERIAL	ATERIAL Fe360										
f _v [N/mm²]	f _u [N/mi	n²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	N										IPE200
A [mm ²]		l₂[mm⁴]		J₃ [mr	n⁴]	J _t	[mm ⁴]	N	V_2 [mm ³]		W_3 [mm ³]
2.981e+003	2.0)51e+00)7	1.540e	+006	6.2	54e+004	2	051e+005	3	3.081e+004
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i ₂ [mr	m]	i ₃	_a [mm]		i _t [mm]		
2.597e+005	4.	776e+00)4	8.296e+001 2.2		73e+001	2	887e+001			
OTHER DATA	OTHER DATA										

TARGET VALUES vs

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	(C_v-T_v)	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-6.6667e+003	Th	-6.6667e+003	3.3333e-007	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	6.6667e+003	Th	6.6667e+003	-3.3333e-007	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	1.5930e-010	1.5930e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-1.8626e-009	-1.8626e-009	-0.0000

computed value
target value
target value kind

value

target value kind (theoretical, cross check, accepted). Th

- theoretical value cross check value (theoretical target value is not known, results obtained with a different

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac 100(Tv - Cv) / Cv relative error percentage

Computational notes:

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

Cr



TEST SCHEDULE CASTALIA	STAT027	
SOLVING	BEAM PROBLE	M SOL.SAR.STAT027
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Simply supported beam with end bending moment

- **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 gualità, travi, misura di errore

Editorial note:

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Note:



TEST SCHEDULE CASTALIA_STAT027		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT027
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [mm]									Co	onstraints
3000						-	A	s shown			
LOAD											
-	Гуре				Value			Po	oint of application	ation	
NODAL	. MOMEI	NT		2.0)00e+(007			Left end		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²] v			α					
2.350e+002	3.600e	+002	2.0	060e+005 3.0		00e-001	1.200e-0	005			
CROSS-SECTIO	Ν									IP	E200
A [mm ²]		J₂[mm⁴]		J₃ [mi	J_3 [mm ⁴]		t[mm⁴]	/	V₂[mm³]	W ₃	[mm ³]
2.981e+003	2.	051e+0	07	1.540e	+006	6.2	254e+004	2	051e+005	3.08	31e+004
W _{pl2} [mm ³]	W	N _{pl3} [mm ³]		i ₂ [m	m]	i;	₃[mm]		i _t [mm]		
2.597e+005	4.	.776e+004		8.2966	+001	2.2	273e+001	2	.887e+001		
OTHER DATA	OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-6.6667e+003	Th	-6.6667e+003	3.3333e-007	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	6.6667e+003	Th	6.6667e+003	-3.3333e-007	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	2.0000e+007	Th	2.0000e+007	3.7253e-009	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-1.8626e-009	-1.8626e-009	-0.0000

vs

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

Computational notes:

Authors: Computed errors:







Problem description:

Simply supported beam with bending moments at both ends

- 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 gualità, travi, misura di errore

Editorial note:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT028		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT028
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length								Constraints			
3000				-			-		-		As shown
LOAD											
	Туре				Value			Р	oint of applic	ation	
NODA	l mome	INT		2.0	00e+0	007			Left end		
NODA	L MOME	NT		1.5	600e+0	007			Right end		
									-		
						-					
MATERIAL										Fe360	
f _v [N/mm ²]	f _u [N/n	nm²]	E [l	N/mm ²]		V	α				
2.350e+002	3.600	+002	2.0	60e+005	60e+005 3.000e-001		1.200e-0	005			
CROSS-SECTIO	ON										IPE200
A [mm ²]		$J_2[mm^4]$		J ₃ [mm⁴]		J	t[mm⁴]		W ₂ [mm ³]	/	N ₃ [mm ³]
2.981e+003	8 2	.051e+0	07	1.540e	+006	6.2	254e+004	2	2.051e+005	3	.081e+004
W _{pl2} [mm ³]	V	W _{pl3} [mm ³]		i ₂ [mi	m]	ia	₃[mm]		i _t [mm]		
2.597e+005	5 4	.776e+0	04	8.296e+001		2.2	2.273e+001		2.887e+001		
OTHER DATA	OTHER DATA										
											· · · · ·

IANGEL IAEGEG

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-1.6667e+003	Th	-1.6667e+003	3.3333e-007	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	1.6667e+003	Th	1.6667e+003	-3.3333e-007	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	2.0000e+007	Th	2.0000e+007	7.4506e-009	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-1.5000e+007	Th	-1.5000e+007	0.0000e+000	-0.0000

vs

Cv Tv TvK	computed value target value target value kind (theoretical, cross check, accepted).
	Th Cr	theoretical value 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(Iv – Cv) / Cv	relative error perce	entage
Computational note	NO:	

Computational notes:

Authors: Computed errors:





Problem description:

Intermediate support beam with distributed constant load and end shear force

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT029		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT029
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	[mm]									C	onstraints
4000=3000+	1000			-			-		-	1	As shown
LOAD											
	Туре			,	Value	•		P	oint of applica	ation	
NODA	AL FORC	E		7.0	00e+	003			Free tip		
force	distribute	d		2.5	570e+	000			-		
									-		
-											
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [I	N/mm ²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005 3.0		00e-001	1.200e-0	005			
CROSS-SECTIC	N									I	PE200
A [mm ²]	,	J₂[mm ⁴]		J ₃ [mm⁴]		J	t[mm⁴]		W ₂ [mm ³]	W	3 [mm ³]
2.981e+003	2.	051e+0	07	1.540e+00		6.2	254e+004	2	2.051e+005	3.0)81e+004
W _{pl2} [mm ³]	N	/ _{pl3} [mm ³]		i ₂ [mi	m]	i	₃[mm]		i _t [mm]		
2.597e+005	4.	776e+0	04	4 8.296e+0		2.2	2.273e+001		.887e+001		
OTHER DATA											

TARGET	VALU	ES
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COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.0933e+003	Th	1.0933e+003	3.3333e-007	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	6.6167e+003	Th	6.6167e+003	-3.3333e-007	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	8.2850e+006	Th	8.2850e+006	1.8626e-009	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	2.4447e-009	2.4447e-009	0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Ty – Cy) / Cy	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable).

Computational notes:

Authors: Computed errors:





Problem description:

Intermediate support beam with distributed constant load

- 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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT030		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT030
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [r							С	onstraints			
6000=3000+3	3000			-			-		-	ŀ	As shown
LOAD											
Т	уре			,	Value			F	Point of application	ation	
force d	listribute	d		2.5	570e+	000			-		
									-		
									-		
-											
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N	J/mm²]		V	α				
2.350e+002	3.600e-	+002	2.06	60e+005 3.000		00e-001	1.200e-	005			
CROSS-SECTION IPE200								PE200			
A [mm ²]		l₂[mm⁴]		J₃[mı	J_3 [mm ⁴]		t[mm ⁴]		W ₂ [mm ³]	W	₃[mm³]
2.981e+003	2.	051e+00	7	1.540e+006		6.2	6.254e+004		2.051e+005	3.0)81e+004
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i ₂ [mm]		i,	₃[mm]		i _t [mm]		
2.597e+005	4.	776e+004	4	8.296e+001		2.2	273e+001		2.887e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-1.3642e-012	-1.3642e-012	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	7.7100e+003	Th	7.7100e+003	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	1.1565e+007	Th	1.1565e+007	3.7253e-009	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

vs

Cv Tv TvK	computed value target value 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(1v - Cv) / Cv	relative error percentage
Commutational mat	

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT031		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT031
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Intermediate support beam with distributed constant load

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT031		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT031
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		STRAIN	NTS				
Full Length [mm]									Co	onstraints
7000=3000+	4000			-			-		-	A	s shown
LOAD											
-	Гуре				Value			P	oint of applic	ation	
force of	distribute	d		2.5	570e+0	00			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.000	De-001	1.200e-0	005			
CROSS-SECTIO	Ν									IP	E200
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm ⁴]		W ₂ [mm ³]	W ₃	[mm ³]
2.981e+003	2.	051e+00	7	1.540e	+006	6.2	254e+004	2	.051e+005	3.08	31e+004
W _{pl2} [mm ³]	W	/ _{pl3} [mm ³]		i ₂ [m	m]	i;	₃[mm]		i _t [mm]		
2.597e+005	4.	776e+00	4	8.2966	296e+001 2.2		2.273e+001 2.		.887e+001		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-2.9983e+003	Th	-2.9983e+003	-3.3334e-007	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	1.0708e+004	Th	1.0708e+004	3.3333e-006	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	2.0560e+007	Th	2.0560e+007	7.4506e-009	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	9.3132e-009	9.3132e-009	0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT032		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT032
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Intermediate support beam with distributed constant load

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT032		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT032
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS										
Full Length	Full Length [mm]								С	onstraints
4000=3000+	4000=3000+1000 -					-		-	A	\s shown
LOAD										
	Туре			Value			Р	oint of applica	ation	
force	distribute	d	2.	570e+(000			-		
force	distribute	d	2.	570e+(000			-		
								-		
								-		
MATERIAL										Fe360
f _v [N/mm ²]	f _u [N/m	m²] l	E [N/mm ²]		V	α				
2.350e+002	3.600e	+002 2	2.060e+005	3.00)0e-001	1.200e-0)05			
CROSS-SECTIO	N								IF	PE200
A [mm ²]		J₂[mm⁴]	J₃ [m	m⁴]	J	J_t [mm ⁴]		W ₂ [mm ³]	W	₃ [mm ³]
2.981e+003	2.	051e+007	1.540	e+006	6.2	54e+004	2	2.051e+005	3.0	81e+004
W _{pl2} [mm ³]	W	′ _{pl3} [mm ³]	i ₂ [m	m]	ia	₃[mm]		i _t [mm]		
2.597e+005	4.	776e+004	8.296	8.296e+001 2.27		73e+001	2	2.887e+001		
OTHER DATA										

TARGET	VALUES
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COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.4267e+003	Th	3.4267e+003	-3.3333e-007	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	4.2833e+003	Th	4.2833e+003	3.3333e-007	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	1.2850e+006	Th	1.2850e+006	-2.3283e-010	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-3.4925e-010	-3.4925e-010	-0.0000

vs

Cv Tv TvK	computed value target value target value kind (theoretical, c	ross check, accepted).
	Th theoretical Cr cross cheo program a	value k value (theoretical target value is not known, results obtained with a different re used as target values).
100(Tv – Cv) / Cv	Ac accepted v relative error percentage	alue (a value which, on the basis of some argument, can be considered acceptable).
Computational not	, ,	

Computational notes:

Authors: Computed errors:



ΤE	ST SCHEDULE CASTALIA_STAT033		
	SOLVING	BEAM PROBLEM	SOL.SAR.STAT033
	FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Intermediate support beam with two distributed constant loads

- 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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT033 SOLVING **BEAM PROBLEM** SOL.SAR.STAT033 FINITE ELEMENT SOLVER CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAI	NTS						
Full Length [mm]											Constr	aints
5000=1000+300	0+1000			-			-			-		As sh	own
LOAD													
1	Гуре			,	Value				Po	int of applic	ation		
force of	distribute	d		2.5	570e+	000				-			
										-			
										-			
										-			
MATERIAL													Fe360
f _v [N/mm ²]	f _u [N/mi	m²]	E [l	N/mm ²]		v		α					
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	00e-001	1.2	200e-0	05				
CROSS-SECTIO	Ν											IPE20	0
A [mm ²]	J	l₂[mm⁴]		J₃ [mm⁴]		J	J _t [mm⁴]		٧	V_2 [mm ³]	V	V₃[mn	n ³]
2.981e+003	2.0	051e+00	7	1.540e	+006	6.	254e+	-004	2.	051e+005	3.	081e+	-004
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i ₂ [mi	m]		i₃ [mm	ı]		i _t [mm]			
2.597e+005	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	Т _{vK}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, J extreme. Beam # 1. Load case # 1	2.5700e+003	Th	2.5700e+003	-9.0949e-013	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	3.8550e+003	Th	3.8550e+003	-4.5475e-013	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.2850e+006	Th	1.2850e+006	2.3283e-010	0.0000
Bending M2, J extreme. Beam # 3. Load case # 1	0.0000e+000	Th	-1.2806e-009	-1.2806e-009	-0.0000

Cv Tv TvK	computed value target value target value kind ((theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100/Tex 0: 0 / 0:	Ac	accepted value (a value which, on the basis of some argument, can be considered acceptable).
100(1V - CV) / CV	relative error perc	entage
Computational note	NC'	

Computational notes:

Authors: Computed errors:





Problem description:

Intermediate support beam with end shear force

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT034		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT034
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAIN	ITS				
Full Length [C	onstraints			
4000=3000+	1000			-			-		-	A	ls shown
LOAD		· · · · · ·									
-	Гуре			,	Value			P	oint of applica	ation	
NODA	L FORC	E		7.0)00e+(003			Free tip		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	Ν									IF	'E200
A [mm ²]		J₂[mm⁴]		J₃ [mi	n⁴]	J	t[mm⁴]		W ₂ [mm ³]	W	₃[mm³]
2.981e+003	2.	051e+00)7	1.540e	+006	6.2	54e+004	2	2.051e+005	3.0	81e+004
W _{pl2} [mm ³]	W	_{pl3} [mm ³		i ₂ [m	m]	ig	₃ [mm]		i _t [mm]		
2.597e+005	2.597e+005 4.776e+004 8.29		8.2966	+001	2.2	73e+001	2	.887e+001			
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, J extreme. Beam # 1. Load case # 1	2.3333e+003	Th	2.3333e+003	3.3333e-007	0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	7.0000e+003	Th	7.0000e+003	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	7.0000e+006	Th	7.0000e+006	2.7940e-009	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage
Computational note	N.

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT035		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT035
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Intermediate support beam with end bending moment

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT035		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT035
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		Ģ	βEC	METRY 8		ISTRAIN	NTS				
Full Length [С	onstraints			
4000=3000+	1000			-			-		-	ŀ	As shown
LOAD		· · · · · · · · · · · · · · · · · · ·									
-	Гуре				Value			Р	oint of application	ation	
NODAL	MOME	ΝT		2.0)00e+0	007			Free tip		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [I	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00)0e-001	1.200e-0	005			
CROSS-SECTIO	Ν									IF	PE200
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm⁴]		W ₂ [mm ³]	W	₃ [mm³]
2.981e+003	2.	051e+00	7	1.540e	+006	6.2	254e+004	2	2.051e+005	3.0	81e+004
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i ₂ [m	m]	i	₃[mm]		i _t [mm]		
2.597e+005	2.597e+005 4.776e+004 8.2		8.2966	+001	2.2	273e+001	2	2.887e+001			
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, J extreme. Beam # 1. Load case # 1	6.6667e+003	Th	6.6667e+003	-3.3333e-007	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	0.0000e+000	Th	2.9104e-011	2.9104e-011	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-1.8626e-009	-1.8626e-009	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	2.0000e+007	Th	2.0000e+007	2.9802e-008	0.0000

vs

Cv Tv TvK	computed value target value target value kind (1	theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
$100(T_{V} - C_{V}) / C_{V}$	Ac relative error perce	accepted value (a value which, on the basis of some argument, can be considered acceptable).
		shage

Computational notes:

Authors: Computed errors:





Problem description:

Beam (end 1 fixed - end 2 simply supported) with internal shear force

- 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:

Pictures 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:


TEST SCHEDULE CASTALIA_STAT036		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT036
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAI	NTS				
Full Length [[mm]		Dx1	l [mm]						C	onstraints
3000			2	000			-		-		As shown
LOAD											
-	Туре			,	Value			Р	oint of applica	ation	
NODA	AL FORC	E		7.0)00e+(003			Dx1		
									-		
									-		
									-		
MATERIAL] [Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm ²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	N									Se	zione1
A [mm ²]		J ₂ [mm ⁴]		J₃ [mr	m ⁴]	J	t[mm⁴]		W ₂ [mm ³]	W	′₃[mm³]
1.000e+000	1.	000e+00	0	0.000e	+000	0.0	00e+000	1	.000e+000	0.0)00e+000
W _{pl2} [mm ³]	W	′ _{pl3} [mm ³]		i₂[mı	m]	i,	₃[mm]		i _t [mm]		
1.000e+000	0.	000e+00	0	1.000e	+000	0.0	00e+000	0	0.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.3704e+003	Th	3.3704e+003	3.7037e-007	0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	3.6296e+003	Th	3.6296e+003	-3.7037e-007	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-3.6296e+006	Th	-3.6296e+006	3.7037e-004	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-1.8626e-009	-1.8626e-009	-0.0000

vs

Cv Tv	computed value target value
IVK	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(Tv – Cv) / Cv	relative error percentage
Computational not	

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT036BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT036BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)





Problem description:

Beam (end 1 fixed - end 2 simply supported) with internal shear force

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT036BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT036BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		G	EOMETRY	& CON	ISTRAIN	ITS				–
Full Length	ength [mm] Dx1 [mm]						(Constraints		
3000			2000			-		-		As shown
LOAD										
	Туре			Value			Poi	nt of applic	ation	
force of	oncentrat	ed	7	.000e+	003			Dx1		
								-		
								-		
								-		
MATERIAL										Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²]		V	α				
2.350e+002	3.600e	+002 2	2.060e+005	3.00)0e-001	1 1.200e-005				
CROSS-SECTIO	ON								S	ezione1
A [mm ²]		J₂[mm⁴]	J ₃ [r	nm⁴]	J	t[mm⁴]	W	/ ₂ [mm ³]	V	/ ₃[mm ³]
1.000e+000) 1.	000e+000	0.00)e+000	0.0	00e+000	1.0)00e+000	0.	000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [I	nm]	i	₃[mm]	i	t[mm]		
1.000e+000) 0.	000e+000) 1.00)e+000	0.0	00e+000	0.0)00e+000		
OTHER DATA										

TARGET VALUES vs

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.3704e+003	Th	3.3704e+003	-3.1074e-004	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	3.6296e+003	Th	3.6296e+003	3.1074e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-3.1111e+006	Th	-3.1111e+006	2.3322e-001	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

Cv	computed value
Tv	target value
TvK	target value kind

lue

lue kind (theoretical, cross check, accepted).

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

100(Tv - Cv) / Cv relative error percentage

Computational notes:

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

Cr





Problem description:

Beam (end 1 fixed - end 2 simply supported) with internal shear force

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT037		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT037
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAIN	ITS				
Full Length	[mm]		Dx1	1 [mm]						C	onstraints
3000			1	500			-		-	1	As shown
LOAD											
	Туре				Value			Р	oint of applica	ation	
NODA	AL FORC	E		7.0)00e+(003			Dx1		
									-		
									-		
									-		
MATERIAL]								Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	N									Se	zione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm⁴]		W ₂ [mm ³]	W	'₃[mm³]
1.000e+000	1.	000e+00	00	0.000e	+000	0.0	00e+000	1	.000e+000	0.0)00e+000
W _{pl2} [mm ³]	W	/ _{pl3} [mm ³]]	i ₂ [m	m]	i,	₃[mm]		i _t [mm]		
1.000e+000	0.	000e+00	00	1.000e	+000	0.0	00e+000	(0.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	4.8125e+003	Th	4.8125e+003	9.0949e-013	0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	-2.1875e+003	Th	-2.1875e+003	0.0000e+000	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-3.9375e+006	Th	-3.9375e+006	-9.3132e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-3.2813e+006	Th	-3.2813e+006	-9.3132e-010	0.0000

vs

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

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT037BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT037BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)





Problem description:

Beam (end 1 fixed - end 2 simply supported) with internal shear force

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT037BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT037BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS										
Full Length	[mm]		Dx1 [mm]						C	onstraints
3000			1500			-		-	A	s shown
LOAD										
	Туре		,	Value			Poi	nt of applic	ation	
force c	oncentrat	ed	7.0	00e+0	03			Dx1		
								-		
								-		
								-		
MATERIAL										Fe360
f _v [N/mm²]	f _u [N/mi	m²] E	E [N/mm²]		V	α				
2.350e+002	3.600e-	+002 2	.060e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	ON								Se	zione1
A [mm ²]	J	l₂[mm⁴]	J₃ [mi	m ⁴]	J _t	J_{t} [mm ⁴]		/ ₂ [mm ³]	W	₃[mm ³]
1.000e+000) 1.(000e+000	0.0006	+000	0.0	00e+000	1.0)00e+000	0.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [m	m]	i ₃	[mm]	i	t[mm]		
1.000e+000	1.000e+000 0.000e+000 1.0			+000	00 0.000e+000 0.000e+000)00e+000		
OTHER DATA										

TARGET VALUES vs

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	4.8125e+003	Th	4.8125e+003	0.0000e+000	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	2.1875e+003	Th	2.1875e+003	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-3.9375e+006	Th	-3.9375e+006	0.0000e+000	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

computed value target value		

Cr

target value kind (theoretical, cross check, accepted).

Th

theoretical value cross check value (theoretical target value is not known, results obtained with a different

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac

100(Tv - Cv) / Cv relative error percentage

Computational notes:

Cv Tv TvK

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







Problem description:

Beam (end 1 fixed - end 2 simply supported) with distributed constant load

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT038		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT038
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		G	iEC	METRY 8		ISTRAIN	NTS				
Full Length [(Constraints		
3000				-			-		-		As shown
LOAD											
	Гуре			,	Value			P	pint of applic	ation	
force of	distribute	d		2.5	570e+0	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	Ν									S	ezione1
A [mm ²]		J₂[mm⁴]		J₃ [mm⁴]		J	t[mm⁴]	1	N ₂ [mm ³]	V	V ₃ [mm ³]
1.000e+000	1.	000e+00	0	0.000e	+000	0.0	00e+000	1	.000e+000	0.	000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i₂[m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	000e+000 0.000e+000			1.000e	+000	0.0	00e+000	0	.000e+000		
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	4.8188e+003	Th	4.8187e+003	-9.0949e-013	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	2.8913e+003	Th	2.8912e+003	-4.5475e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-2.8913e+006	Th	-2.8913e+006	-9.3132e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

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

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT039		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT039
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Beam (end 1 fixed - end 2 simply supported) with distributed linear load

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:

Pictures 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:



TEST SCHEDULE CASTALIA STAT039 SOLVING **BEAM PROBLEM** SOL.SAR.STAT039 CLEVER (SARGON ©) FINITE ELEMENT SOLVER

			GE	OMETRY 8	CON	STRAIN	NTS					
Full Length							C	Constraints				
3000				-			-		-		As shown	
LOAD												
	Туре				Value			F	Point of application	ation		
force line	arly disti	ibuted		2.5 0.0	2.570e+000- 0.000e+000			-				
									-			
									-			
									-			
MATERIAL											Fe360	
f _v [N/mm ²]	f _u [N/r	nm²]	E	[N/mm ²]		V	α					
2.350e+002	3.600	e+002	2.0)60e+005	3.00	0e-001	1.200e-0)05				
CROSS-SECTIO	ON									S	ezione1	
A [mm ²]		J ₂ [mm	4]	J₃[mı	m⁴]	J	t[mm ⁴]		W_2 [mm ³]	Ν	/ ₃ [mm ³]	
1.000e+000) 1	.000e+	000	0.000e	+000	0.0	00e+000		1.000e+000	0.0	000e+000	
W _{pl2} [mm ³]	W _{pl3} [mm ³]			i ₂ [m	m]	i	₃[mm]		i _t [mm]			
1.000e+000) (.000e+	000	1.000e	+000	0.0	00e+000		0.000e+000			
OTHER DATA												

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.0840e+003	Th	3.0840e+003	-4.5475e-013	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	7.7100e+002	Th	7.7100e+002	1.2506e-012	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.5420e+006	Th	-1.5420e+006	-9.3132e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-1.1642e-010	-1.1642e-010	-0.0000

vs

Cv Tv ΤvΚ computed value target value

> Th Cr

target value kind (theoretical, cross check, accepted).

theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).

accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac 100(Tv - Cv) / Cv relative error percentage

Computational notes:

Authors: Computed errors:





Problem description:

Cantilever, intermediate support, with end shear force

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT040		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT040
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAIN	ITS				
Full Length [Full Length [mm]									C	onstraints
4000=3000+	1000			-			-		-	A	s shown
LOAD											
1	Гуре				Value			P	oint of applic	ation	
NODA	L FORC	E		7.0)00e+(003			Free tip		
									-		
									-		
							-				
MATERIAL									Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]	n²] <i>v</i>		α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00)0e-001	1.200e-0	005			
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]		J₂[mm⁴]	m^4] J_3 [mm ⁴]		J_3 [mm ⁴]		t[mm⁴]		W ₂ [mm ³]	W;	₃[mm³]
1.000e+000	1.	000e+00	00	0.000e	+000	0.0	00e+000	1	.000e+000	0.0	00e+000
W _{pl2} [mm ³]	W	′ _{pl3} [mm ³]	i ₂ [m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	0.	000e+00	000 1.000e+00		+000	0.0	00e+000	0	.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-3.5000e+003	Th	-3.5000e+003	-7.2760e-012	0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	-7.0000e+003	Th	-7.0000e+003	-1.4552e-011	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	3.5000e+006	Th	3.5000e+006	7.4506e-009	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	7.0000e+006	Th	7.0000e+006	1.4901e-008	0.0000

vs

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

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT041		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT041
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)







Problem description:

Cantilever, intermediate support, with distributed constant load

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT041		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT041
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		C	GEC	METRY 8		ISTRAIN	NTS					
Full Length [Full Length [mm]									С	onstraints	
4000=3000+	1000			-			-		-	ŀ	As shown	
LOAD												
-	Гуре				Value			Р	oint of applic	ation		
force of	distribute	d		2.5	570e+0	000			-			
									-			
									-			
							-					
MATERIAL]									Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α					
2.350e+002	3.600e	+002	2.0	60e+005	3.00)0e-001	1.200e-0	005				
CROSS-SECTIO	Ν									Se	zione1	
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm ⁴]		W ₂ [mm ³]	W	₃ [mm ³]	
1.000e+000	1.	000e+00	0	0.000e	+000	0.0	00e+000		1.000e+000	0.0	00e+000	
W _{pl2} [mm ³]	W	′ _{pl3} [mm ³]		i ₂ [m	m]	i	₃[mm]		i _t [mm]			
1.000e+000	0.	000e+00	0	1.000e+000		0.0	00e+000	(0.000e+000			
OTHER DATA												

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	4.1763e+003	Th	4.1762e+003	-9.0949e-013	-0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	4.5475e-013	4.5475e-013	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	1.2850e+006	Th	1.2850e+006	-2.3283e-010	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	5.8208e-011	5.8208e-011	0.0000

Cv Tv TvK	computed value target value 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).
100(Ty – Cy) / Cy	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage

Computational notes:

Authors: Computed errors:





Problem description:

Beam (both ends fixed) with internal shear force

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT042		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT042
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	[mm]	[Dx1 [mm]						Co	onstraints	
3000			1000			-		-	A	s shown	
LOAD											
	Туре			Value			Poin	t of applica	ation		
NODA	AL FORC	E	7.	000e+0	003			Dx1			
								-			
								-			
								-			
MATERIAL									Fe360		
f _v [N/mm ²]	f _u [N/m	m²] I	E [N/mm ²]		V	α					
2.350e+002	3.600e-	+002 2	2.060e+005	3.00	0e-001	1.200e-0	005				
CROSS-SECTIO	N								Sea	zione1	
A [mm ²]		J₂[mm⁴]	J ₃ [n	າm ⁴]	J	t[mm⁴]	W2	[mm ³]	W ₃	[mm ³]	
1.000e+000	1.0	000e+000	0.000	e+000	0.0	00e+000	1.00	00e+000	0.0)0e+000	
W_{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [n	าm]	ig	₃ [mm]	i _t	i _t [mm]			
1.000e+000	0.0	000e+000	1.000	1.000e+000		00e+000	0.00	00e+000			
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	5.1852e+003	Th	5.1852e+003	1.8518e-007	0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	-1.8148e+003	Th	-1.8148e+003	1.8519e-007	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-3.1111e+006	Th	-3.1111e+006	-1.1111e-004	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-2.0741e+006	Th	-2.0741e+006	-7.4074e-005	0.0000

vs

Cv Tv TvK	computed value target value 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).
$100(T_{V} - C_{V}) / C_{V}$	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable).

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT042BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT042BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)
	7.000e+003 N	, ^Z
•		

Problem description:

Beam (both ends fixed) with internal shear force

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT042BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT042BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS														
Full Length	h [mm] Dx1 [mm]							Coi	nstraints					
3000			1000						As	shown				
LOAD														
	Туре			Value			Poi	nt of applic	ation					
force of	concentrat	ed	7.0)00e+0	03			Dx1						
								-						
								-						
-														
MATERIAL										Fe360				
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²]		V	α								
2.350e+002	3.600e	+002 2	2.060e+005	3.00	0e-001	1.200e-0	005							
CROSS-SECTIO	ON								Sez	ione1				
A [mm ²]		J₂[mm⁴]	J₃[m	m⁴]	J	[mm⁴]	W	2 [mm ³]	W ₃ [mm ³]				
1.000e+000) 1.	000e+000	0.0006	9+000) 0.000e+0		1.0	00e+000	0.00	0e+000				
W _{pl2} [mm ³]	W	/ _{pl3} [mm ³]	i ₂ [m	i ₂ [mm]		i₃ [mm]		i₃ [mm]		i₃ [mm]		t[mm]		
1.000e+000) 0.	000e+000	1.0006	e+000	0 0.000e+000		0.0	00e+000						
OTHER DATA														

TARGET VALUES vs **COMPUTED VALUES**

Description	T_{v}	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	5.1852e+003	Th	5.1852e+003	3.1130e-004	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	1.8148e+003	Th	1.8148e+003	-3.1130e-004	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-3.1111e+006	Th	-3.1111e+006	-1.1109e-004	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	1.5556e+006	Th	1.5556e+006	-2.3378e-001	-0.0000

Cv	computed value
Tv	target value
TvK	target value kind (

target value kind (theoretical, cross check, accepted).

theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable).

Ac

100(Tv - Cv) / Cv relative error percentage

Computational notes:

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

Th

Cr





Problem description:

Beam (both ends fixed) with internal shear force

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:

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Note:



TEST SCHEDULE CASTALIA_STAT043		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT043
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	[mm]		Dx ⁻	1 [mm]					Constraints		
3000			1	500			-		-	ļ	As shown
LOAD											
	Туре			,	Value			Po	pint of applic	ation	
NOD	AL FORC	E		7.0)00e+(003			Dx1		
									-		
									-		
	-										
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²]	V		α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	DN									Se	zione1
A [mm ²]		J₂[mm⁴]		J₃ [mr	m⁴]	J	J _t [mm ⁴]		<i>N</i> ₂ [mm ³]	W	₃ [mm³]
1.000e+000	1.	000e+00)0	0.000e	+000	0.0	00e+000	1	.000e+000	0.0	00e+000
W _{pl2} [mm ³]	W	՝ _{pl3} [mm ³]		i₂[mı	m]	i,	₃[mm]		i _t [mm]		
1.000e+000	0.	000e+00	00	1.000e	+000	0.0	00e+000	0	.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	Τ _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	3.5000e+003	Th	3.5000e+003	-9.0949e-013	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	-3.5000e+003	Th	-3.5000e+003	9.0949e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-2.6250e+006	Th	-2.6250e+006	4.6566e-010	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-2.6250e+006	Th	-2.6250e+006	4.6566e-010	-0.0000

vs

Cv Tv TvK	computed value target value target value kind	(theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100(Tv – Cv) / Cv	Ac relative error perc	accepted value (a value which, on the basis of some argument, can be considered acceptable). entage
Computational note	<i>.</i>	

Computational notes:

Authors: Computed errors:





Problem description:

Beam (both ends fixed) with internal shear force

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT043BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT043BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS										\neg
Full Length	[mm]		Dx1 [mm]							Constraints
3000			1500			-		-		As shown
LOAD	7									
	Туре			Value			Po	int of applic	ation	
force c	oncentrat	ed	7	.000e+0	003			Dx1		
								-		
								-		
								-		
MATERIAL										Fe360
f _v [N/mm²]	f _u [N/mı	n²]	E [N/mm ²]		V	α				
2.350e+002	3.600e+	+002	2.060e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIO	DN									Sezione1
A [mm ²]	J	l₂[mm⁴]	J ₃ [r	nm⁴]	J	t[mm⁴]	V	V_2 [mm ³]		W_3 [mm ³]
1.000e+000	1.0	000e+00	0.00)e+000	0.0	000e+000		1.000e+000		0.000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [I	nm]	i	₃[mm]	i _t [mm]			
1.000e+000	0.0	000e+00	0 1.00)e+000	0.000e+000			000e+000		
OTHER DATA										

TARGET VALUES vs

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.5000e+003	Th	3.5000e+003	0.0000e+000	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	3.5000e+003	Th	3.5000e+003	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-2.6250e+006	Th	-2.6250e+006	0.0000e+000	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	2.6250e+006	Th	2.6250e+006	0.0000e+000	0.0000

Cv	computed value
Tv	target value
TvK	target value kind (theo

target value kind (theoretical, cross check, accepted).

Th

theoretical value cross check value (theoretical target value is not known, results obtained with a different

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac 100(Tv - Cv) / Cv relative error percentage

Computational notes:

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

Cr





Problem description:

Beam (both ends fixed) with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT044		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT044
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [mm]							(Constraints		
3000				-			-		-		As shown
LOAD											
-	Гуре				Value)		Р	oint of applic	ation	
force	distribute	d		2.5	570e+	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.0	00e-001	1.200e-	005			
CROSS-SECTIO	N									S	ezione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm ⁴]		W ₂ [mm ³]	W	/ ₃ [mm ³]
1.000e+000	1.	000e+00)0	0.000e	+000	0.0)00e+000	00e+000 1.000e+000		0.0	000e+000
W_{pl2} [mm ³]	W	′ _{pl3} [mm ³]	i ₂ [m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	0.	000e+00	00	1.000e	+000	0.000e+000 0.000e			.000e+000		
OTHER DATA	OTHER DATA										

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.8550e+003	Th	3.8550e+003	-4.5475e-013	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	3.8550e+003	Th	3.8550e+003	-4.5475e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.9275e+006	Th	-1.9275e+006	-6.9849e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	1.9275e+006	Th	1.9275e+006	-4.6566e-010	-0.0000

Cv Tv TvK	computed value target value target value kind	(theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100/TH ON / OH	Ac	accepted value (a value which, on the basis of some argument, can be considered acceptable).
100(10 - C0) / C0	relative error perc	enage
Computational note		

Computational notes:

Authors: Computed errors:





Problem description:

Beam (both ends fixed) with internal distributed constant load

- 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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT045		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT045
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS															
Full Length [mm]	Dx1 [mm]					Dx2 [mm]					Cons	straints		
3000			1	000				2000		-		As s	shown		
LOAD															
	Гуре			,	Value	;			Po	int of applic	ation				
force of	distribute	d		2.5	70e+	-000				Dx1-Dx2					
										-					
										-					
										-					
MATERIAL													Fe360		
f _v [N/mm ²]	f _u [N/mm ²]		n ²] E [N/m		mm²] E [N			V		α					
2.350e+002	3.600e-	+002 2	2.06	60e+005	3.0	00e-00)1	1.200e-(005						
CROSS-SECTIO	Ν										5	Sezic	one1		
A [mm ²]		J₂[mm⁴]		J₃[mr	n⁴]		J _t	[mm ⁴]	۷	1 ₂ [mm ³]	1	W ₃ [m	nm³]		
1.000e+000	1.0	000e+000)	0.000e	+000)	0.0	00e+000 1.00		000e+000	0	.000	e+000		
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i₂ [mı	m]		i ₃	[mm]		i _t [mm]					
1.000e+000	0.0	000e+000)	1.000e	+000	0.000e+000 0.000e+			000e+000						
OTHER DATA															

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.2850e+003	Th	1.2850e+003	-2.2737e-013	-0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	1.2850e+003	Th	1.2850e+003	-2.2737e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-9.2806e+005	Th	-9.2806e+005	4.4445e-005	-0.0000
Bending M2, J extreme. Beam # 3. Load case # 1	9.2806e+005	Th	9.2806e+005	-4.4445e-005	-0.0000

vs

Cv Tv TvK	computed value target value target value kind	(theoretical, cross check, accepted).
	Th Cr	theoretical value 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(Tv – Cv) / Cv	relative error perc	entage
Computational note	oc.	

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT045BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT045BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)
2.57 kN/ m	2.	57 kN/ m €
+1.285+₩285 kN	0.928056 kN	m 0.928056 kN m
-1.28	5 kN	8194 kN m

Problem description:

Beam (both ends fixed) with internal distributed constant load

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:

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.

Note:



 TEST SCHEDULE

 CASTALIA_STAT045BIS

 SOLVING
 BEAM PROBLEM

 FINITE ELEMENT
 SOLVER

 CLEVER (SARGON ©)

			GEC	METRY 8	k CON	ISTRAIN	ITS				
Full Length [mm] Dx1 [1 [mm]			Dx2 [mm]			Co	nstraints
3000			1	000			2000		-	A	s shown
LOAD											
	Туре	;		,	Value			Poi	nt of applica	tion	
force line	early d	listributed		2.57 2.5	70e+00 70e+0	00- 00			Dx1-Dx2		
									-		
									-		
	-					-					
MATERIAL											Fe360
f _y [N/mm ²]	f _u [[N/mm ²]	E [I	N/mm²]		V	α				
2.350e+002	3.6	600e+002	2.0	60e+005	3.00	0e-001	1.200e-0	05			
CROSS-SECTIO	ON									IP	E200
A [mm ²]		J₂[mm ⁴]	J₃[mı	m⁴]	J	t[mm ⁴]	W	/ ₂ [mm ³]	W ₃	[mm ³]
2.981e+003	3	2.051e+	007	1.540e	+006	6.2	254e+004 2.0)51e+005	3.08	31e+004
W _{pl2} [mm ³]		W _{pl3} [mn	າ"]	i ₂ [m	m]	į	₃[mm] i		t[mm]		
2.597e+00	5	4.776e+	004	8.296e	+001	2.2	73e+001	2.8	387e+001		
OTHER DATA]										

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.2850e+003	Th	1.2850e+003	2.5700e-004	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	1.2850e+003	Th	1.2850e+003	2.5700e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-9.2806e+005	Th	-9.2806e+005	-1.7129e-001	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	9.2806e+005	Th	9.2806e+005	1.7129e-001	0.0000

vs

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).

 $100(Tv-Cv) \ / \ Cv \quad \ relative \ error \ percentage$

Computational notes:

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





Problem description:

Beam (both ends fixed) with internal distributed constant loads

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:

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Note:



TEST SCHEDULE CASTALIA_STAT046		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT04
FINITE ELEMENT	SOLVER	CLEVER (SARGON

			GEC	METRY 8		NSTRAIN	ITS				
Full Leng	th [mm]	[Dx1 [mm]		Dx2 [mm] Dx3 [mm] Dx4				[mm]
300)0			400		100	00		2000	20	600
Constr	raint	ts									
As sh	owr	ו									
LOAD											
-	Тур	e			Value)			Point of applic	cation	
force	dist	ributed		2.5	570e+	000			Dx1-Dx2	2	
force	dist	ributed		2.5	70e+	000			Dx3-Dx4	Ļ	
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u	[N/mm ²]	E [I	N/mm²]		V	α				
2.350e+002	3.	600e+002	2.0	60e+005	3.0	00e-001	1.200e	-005			
CROSS-SECTIO	N									Sez	zione1
A [mm ²]		J₂[mm⁴]	J₃ [mr	m⁴]	J	[mm⁴]		W ₂ [mm ³]	W ₃	[mm ³]
1.000e+000		1.000e+	000	0.000e	+000	0.0	00e+000		1.000e+000	0.00	00e+000
W _{pl2} [mm ³]		W _{pl3} [mn	า ³]	i ₂ [mi	m]	ig	[mm]		i _t [mm]		
1.000e+000		0.000e+	000	1.000e	+000	0.0	00e+000		0.000e+000		
OTHER DATA											

TARGET V	ALUES	vs
----------	-------	----

COMPUTED VALUES

Description	T_{ν}	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 4. Load case # 1	1.5420e+003	Th	1.5420e+003	-4.5475e-013	-0.0000
Shear T3, I extreme. Beam # 3. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-8.1212e+005	Th	-8.1212e+005	-9.3132e-010	0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	2.6728e+005	Th	2.6728e+005	6.4028e-010	0.0000

Cv Tv TvK

computed value target value

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(Tv - Cv) / Cv relative error percentage

Computational notes:

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



TEST SCHEDULE CASTALIA_STAT046BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT046BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Beam (both ends fixed) with two internal distributed constant loads

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:

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Note:



TEST SCHEDULE CASTALIA_STAT046BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT046BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS]
Full Leng	gth [mm]	[Dx1 [mm]		Dx2 [r	nm]	D	x3 [mm]	Dx4	[mm]
30	00		400		100	0		2000	26	00
Const	raints									
As sh	iown									
LOAD										
	Туре			Value			F	Point of applic	ation	
force line	arly distributed		2.57 2.5	70e+0 70e+0	00- 000			Dx1-Dx2		
force line		2.570e+000- 2.570e+000			Dx3-Dx4					
			-							
				-						
MATERIAL										Fe360
f _v [N/mm ²]	f _u [N/mm ²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e+002	2.0	60e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIC	N								Sez	ione1
A [mm ²]	J₂[mm ⁴]	J₃[mr	m ⁴]	J _t	[mm ⁴]		W_2 [mm ³]	W ₃	[mm ³]
1.000e+000	1.000e+	000	0.000e	+000	0.0	00e+000		1.000e+000	0.00	0e+000
W _{pl2} [mm ³]	W_{pl2} [mm ³] W_{pl3} [mm ³]		i₂ [mı	m]	i ₃	[mm]	i _t [mm]			
1.000e+000 0.000e+000			1.000e+000 0.00		00e+000	(0.000e+000			
OTHER DATA										

TARGET VALUES **COMPUTED VALUES** vs

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.5420e+003	Th	1.5420e+003	-2.2737e-013	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	1.5420e+003	Th	1.5420e+003	6.8212e-013	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-8.1212e+005	Th	-8.1212e+005	8.2240e-002	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	8.1212e+005	Th	8.1212e+005	-8.2240e-002	-0.0000

Cv computed value Tv TvK

target value target value kind (theoretical, cross check, accepted).

Th theoretical value

cross check value (theoretical target value is not known, results obtained with a different Cr

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac 100(Tv - Cv) / Cv relative error percentage

Computational notes:

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

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Problem description:

Beam (both ends fixed) with internal distributed constant load

- 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

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Note:



TEST SCHEDULE CASTALIA_STAT047		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT047
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	[mm]		Dx1	l [mm]						С	onstraints
3000			1	000			-		-	A	\s shown
LOAD											
	Туре			,	Value			Po	int of applic	ation	
force	distribute	d		2.5	570e+0	000			Left end-Dx	(1	
									-		
									-		
	-										
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [ľ	N/mm²]	²] ν α						
2.350e+002	3.600e-	+002	2.06	60e+005	3.00	00e-001 1.20		005			
CROSS-SECTION Sezione1									zione1		
A [mm ²]	,	J₂[mm⁴]		J₃ [mr	m ⁴]	J	t[mm⁴]	٧	V₂[mm³]	W	₃[mm³]
1.000e+000	1.	000e+00	0	0.000e	+000	0.0	00e+000	1.	000e+000	0.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i ₂ [mi	i ₂ [mm] i ₃		₃[mm]		i _t [mm]		
1.000e+000	0.	000e+00	0	1.000e	+000) 0.000e+00		0.	000e+000		
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.3320e+003	Th	2.3320e+003	3.7037e-008	0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	-2.3796e+002	Th	-2.3796e+002	3.7037e-008	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-7.8528e+005	Th	-7.8528e+005	2.2222e-005	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	2.1417e+005	Th	2.1417e+005	-3.3333e-005	-0.0000

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

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT047BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT047BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Beam (both ends fixed) with internal distributed constant load

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:

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Note:


TEST SCHEDULE CASTALIA_STAT047BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT047BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS													
Full Length	[mm]	Dx1 [mm]								С	onstraints		
3000			1	000			-		-	A	\s shown		
LOAD													
	Туре			,	Value			Po	int of applica	ation			
force line	arly dist	ibuted		2.57 2.5	70e+00 70e+0	00- 00			Left end-Dx	1			
									-				
									-				
									-				
MATERIAL	F					Fe360							
f _y [N/mm ²]	f _u [N∕r	nm²]	E [N/mm²]		V	α						
2.350e+002	3.600	e+002	2.0	60e+005	3.00	0e-001	1.200e-0	005					
CROSS-SECTIO	ON									Se	zione1		
A [mm ²]		J₂[mm⁴]		J_3 [mm ⁴]		J₃ [mm⁴]		J	t[mm⁴]	۷	/ ₂ [mm ³]	W	₃[mm ³]
1.000e+000) 1	.000e+	000	0.000e	+000	0.0	00e+000	1.	000e+000	0.0	00e+000		
W _{pl2} [mm ³]	١	V _{pl3} [mr	n ³]	i ₂ [m	i ₂ [mm]		₃[mm]		i _t [mm]				
1.000e+000) (.000e+	000	1.000e+000 0.00		00e+000	0.	000e+000					
OTHER DATA													

TARGET VALUES

COMPUTED VALUES

Description	Τ _ν	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.3320e+003	Th	2.3320e+003	-1.9033e-004	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	2.3796e+002	Th	2.3796e+002	-6.6667e-005	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-7.8528e+005	Th	-7.8528e+005	1.1424e-001	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	2.1417e+005	Th	2.1417e+005	-5.7144e-002	-0.0000

vs

Cv	computed value	
Τv	target value	
TvK	target value kind	(theoretical, cross check, accepted).
	- Th	theoretical value
	Cr	cross check value (theoretical tar

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

Ac $100(Tv-Cv) \ / \ Cv \quad \ relative \ error \ percentage$

Computational notes:

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



TEST SCHEDULE CASTALIA_STAT048		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT048
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Beam (both ends fixed) with two distributed linear loads

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:

Pictures 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:



SOLVING	BEAM PROBLEM	SOL.SAR.STAT048
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

Full Length [mm] Dx1 [mm] Constraints 3000 1500 - As shown LOAD Value Point of application force linearly distributed 0.000e+000- 2.570e+000 Left end-Dx1 force linearly distributed 2.570e+000- 0.000e+000 Dx1-Right end for (linearly distributed 2.570e+000- 0.000e+000 Dx1-Right end for (linearly distributed 2.060e+000 3.000e-001 1.200e-005 for (linearly distributed 2.060e+005 3.000e-001 1.200e-005 Imm 2.350e+002 3.600e+002 2.060e+000 0.000e+000 0.000e+000 0.000e+000 A [mm ²] J2[mm ⁴] J3[mm ⁴] J1[mm ⁴] W2[mm ³] <t< th=""><th colspan="8">GEOMETRY & CONSTRAINTS</th></t<>	GEOMETRY & CONSTRAINTS											
3000 1500 - As shown LOAD	Full Length	[mm]		Dx1	1 [mm]							Constraints
LOAD Type Value Point of application force linearly distributed 0.000e+000- 2.570e+000 Left end-Dx1 force linearly distributed 2.570e+000- 0.000e+000 Dx1-Right end force linearly distributed 2.570e+000- 0.000e+000 Dx1-Right end material - - force linearly distributed 2.570e+000- 0.000e+000 Dx1-Right end force linearly distributed 2.570e+000- 0.000e+000 Fe360 fv [N/mm ²] fu [N/mm ²] V α 2.350e+002 3.600e+002 2.060e+005 3.000e-001 CROSS-SECTION Sezione1 Sezione1 A [mm ²] J2[mm ⁴] J3[mm ⁴] J1[mm ⁴] W2[mm ³] 1.000e+000 0.000e+000 0.000e+000 0.000e+000 0.	3000			1	500			-		-		As shown
Type Value Point of application force linearly distributed 0.000e+000- 2.570e+000 Left end-Dx1 force linearly distributed 2.570e+000- 0.000e+000 Dx1-Right end force linearly distributed 2.570e+000- 0.000e+000 Dx1-Right end MATERIAL - - f _V [N/mm ²] f _u [N/mm ²] V α 2.350e+002 3.600e+002 2.060e+005 3.000e-001 1.200e-005 CROSS-SECTION Sezione1 Sezione1 A [mm ²] J ₂ [mm ⁴] J ₃ [mm ⁴] W ₂ [mm ³] W ₃ [mm ³] 1.000e+000 1.000e+000 0.000e+000 1.000e+000 0.000e+000 W _{pl2} [mm ³] W _{pl3} [mm ³] i ₂ [mm] i ₃ [mm] i ₁ [mm] 1.000e+000 0.000e+000 0.000e+000 0.000e+000 0.000e+000 W _{pl2} [mm ³] W _{pl3} [mm ³] i ₂ [mm] i ₃ [mm] i ₁ [mm] 1.000e+000 0.000e+000 0.000e+000 0.000e+000 0.000e+000	LOAD											
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		Туре				Value			Poi	nt of applic	ation	
force linearly distributed 2.570e+000- 0.000e+000 Dx1-Right end 0.000e+000 - - MATERIAL - - f _v [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 Sezione1 A [mm ²] J ₂ [mm ⁴] J ₃ [mm ⁴] J ₁ [mm ⁴] W ₂ [mm ³] 1.000e+000 1.000e+000 0.000e+000 1.000e+000 0.000e+000 W _{pl2} [mm ³] W _{pl3} [mm ³] i ₂ [mm] i ₃ [mm] i ₁ [mm] 1.000e+000 0.000e+000 0.000e+000 0.000e+000 0.000e+000 OTHER DATA	force line	arly distri	buted		0.00 2.5)0e+0(70e+0)0- 00			Left end-D>	(1	
MATERIAL - f _v [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 Sezione1 A [mm ²] J ₂ [mm ⁴] J ₃ [mm ⁴] J ₁ [mm ⁴] W ₂ [mm ³] 1.000e+000 1.000e+000 0.000e+000 1.000e+000 0.000e+000 W _{pl2} [mm ³] W _{pl3} [mm ³] i ₂ [mm] i ₃ [mm] i ₁ [mm] 1.000e+000 0.000e+000 0.000e+000 0.000e+000 0.000e+000 OTHER DATA	force line	arly distri	buted		2.57 0.00	70e+00 00e+0	00- 00		0	0x1-Right e	nd	
MATERIAL Fe360 f _v [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 Sezione1 A [mm ²] J ₂ [mm ⁴] J ₃ [mm ⁴] J ₄ [mm ⁴] W ₂ [mm ³] 1.000e+000 1.000e+000 0.000e+000 1.000e+000 0.000e+000 W _{pl2} [mm ³] W _{pl3} [mm ³] i ₂ [mm] i ₃ [mm] i ₄ [mm] 1.000e+000 0.000e+000 0.000e+000 0.000e+000 0.000e+000 OTHER DATA Image: Secone 1 Image: Secone 1 Image: Secone 1										-		
MATERIAL Fe360 f _v [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 Sezione1 A [mm ²] J ₂ [mm ⁴] J ₃ [mm ⁴] J ₁ [mm ⁴] W ₂ [mm ³] W ₃ [mm ³] 1.000e+000 1.000e+000 0.000e+000 1.000e+000 0.000e+000 W _{pl2} [mm ³] W _{pl3} [mm ³] i ₂ [mm] i ₃ [mm] i ₁ [mm] 1.000e+000 0.000e+000 0.000e+000 0.000e+000 0.000e+000 OTHER DATA												
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	MATERIAL	Fe30					Fe360					
2.350e+002 3.600e+002 2.060e+005 3.000e-001 1.200e-005 Sezione1 A [mm ²] J ₂ [mm ⁴] J ₃ [mm ⁴] J ₁ [mm ⁴] W ₂ [mm ³] W ₃ [mm ³] 1.000e+000 1.000e+000 0.000e+000 0.000e+000 1.000e+000 0.000e+000 W pl2 [mm ³] W pl3 [mm ³] i2 [mm] i3 [mm] i1 [mm] i< [mm]	f _y [N/mm ²]	f _u [N/m	m²]	E [I	N/mm²]		v	α				
CROSS-SECTION Sezione1 A [mm ²] J ₂ [mm ⁴] J ₃ [mm ⁴] J ₁ [mm ⁴] W ₂ [mm ³] W ₃ [mm ³] 1.000e+000 1.000e+000 0.000e+000 1.000e+000 0.000e+000 W pl2 [mm ³] W pl3 [mm ³] i2 [mm] i3 [mm] it [mm] 1.000e+000 0.000e+000 0.000e+000 0.000e+000 0.000e+000 OTHER DATA	2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	05			
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	CROSS-SECTIO	ON										Sezione1
1.000e+000 1.000e+000 0.000e+000 1.000e+000 0.000e+000 W pl2 [mm³] W pl3 [mm³] i2 [mm] i3 [mm] it [mm] 0.000e+000 1.000e+000 0.000e+000 1.000e+000 0.000e+000 0.000e+000 0.000e+000 OTHER DATA	A [mm ²]		J₂[mm ⁴		J₃ [mr	n ⁴]	J	[mm⁴]	W	/ ₂ [mm ³]		W ₃ [mm ³]
W pl2 [mm³] W pl3 [mm³] i2 [mm] i3 [mm] i t [mm] 1.000e+000 0.000e+000 1.000e+000 0.000e+000 0.000e+000 OTHER DATA	1.000e+000) 1.	000e+	000	0.000e	+000	0.0	00e+000	1.0)00e+000	().000e+000
1.000e+000 0.000e+000 1.000e+000 0.000e+000 0.000e+000 OTHER DATA	W _{pl2} [mm ³]	i^{3} W _{pl3} [mm ³] i ₂ [mm] i ₃ [mm] i _t [mr		i ₂ [mm]		t[mm]						
OTHER DATA	1.000e+000) 0.	000e+	000	1.000e+000 (0.0	00e+000	0.0)00e+000		
	OTHER DATA											

TARGET VALUES vs **COMPUTED VALUES**

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.9275e+003	Th	1.9275e+003	-9.0949e-013	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	0.0000e+000	Th	2.2737e-013	2.2737e-013	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.2047e+006	Th	-1.2047e+006	6.9849e-010	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-7.2281e+005	Th	-7.2281e+005	4.6566e-010	-0.0000

Cv	computed value
Tv	target value
TvK	target value kind (theoretical, cro
	T I II II I

oss check, accepted). theoretical value Th

- Cr
 - cross check value (theoretical target value is not known, results obtained with a different

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac

100(Tv – Cv) / Cv relative error percentage

Computational notes:

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



TEST SCHEDULE CASTALIA_STAT048BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT048BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Beam (both ends fixed) with two distributed linear loads

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT048BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT048BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©

	GEOMETRY & CONSTRAINTS							_			
Full Length	[mm]		Dx1	1 [mm]							Constraints
3000			1	500			-		-		As shown
LOAD											
	Туре				Value			Po	int of applic	ation	
force linea	arly distrik	outed		0.00 2.5)0e+0 70e+0	00- 00			Left end-Dx	(1	
force linea	arly distrik	outed		2.57 0.00	70e+0 00e+0	00- 00		[Dx1-Right e	nd	
							-				
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [I	N/mm ²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	N										Sezione1
A [mm ²]		J₂[mm ⁴]		J₃ [mr	m⁴]	J	t[mm⁴]	V	I_2 [mm ³]		W₃[mm³]
1.000e+000	1.	000e+00	0	0.000e	+000	0.0	00e+000	1.0	000e+000	C	0.000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i₂[mı	m]	i;	₃[mm]		i _t [mm]		
1.000e+000	0.	000e+00	00e+000 1.000e+000 0.000e+000 0.000e+000								
OTHER DATA											
								_			

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.9275e+003	Th	1.9275e+003	-4.5475e-013	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	1.9275e+003	Th	1.9275e+003	3.1832e-012	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.2047e+006	Th	-1.2047e+006	-3.4925e-009	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	1.2047e+006	Th	1.2047e+006	1.1642e-009	0.0000

vs

Cv	computed value						
Tv	target value						
ΤvΚ	target value kind (Th Cr	(theoretical, cross check theoretical value cross check value (the program are used as	k, accepted). heoretical target va s target values).	alue is r	not known, results ob	ptained with a differe	nt
100(Tv – Cv) / Cv	Ac relative error perc	accepted value (a va	alue which, on the	basis o	f some argument, ca	n be considered acc	eptable).

Computational notes:

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





Problem description:

Beam (both ends fixed) with distributed linear load

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:

Pictures 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:



TEST SCHEDULE CASTALIA STAT049 SOLVING **BEAM PROBLEM** SOL.SAR.STAT049 CLEVER (SARGON ©) FINITE ELEMENT SOLVER

			GEO	OMETRY 8		STRAIN	ITS				
Full Length	[mm]									(Constraints
3000				-			-		-		As shown
LOAD]										
	Туре			,	Value			Р	oint of applic	ation	
force line	early dis	tributed		0.0 2.5	00e+00 70e+00)0-)0			_		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/	ˈmm²]	E [[N/mm ²]	1	v	α				
2.350e+002	3.600)e+002	2.0	060e+005 3.0		De-001	1.200e-0	005			
CROSS-SECTION	ON									S	ezione1
A [mm ²]		J ₂ [mm	4]	J₃[m	m⁴]	J	t[mm⁴]		W ₂ [mm ³]	V	V ₃ [mm ³]
1.000e+000)	1.000e+	000	0.0006	+000	0.0	00e+000	1	.000e+000	0.	000e+000
W _{pl2} [mm ³]		W _{pl3} [mr	n ³]	i₂[m	m]	ia	3 [mm]		i _t [mm]		
1.000e+000)	0.000e+	000	1.000e	+000	0.0	00e+000	(0.000e+000		
OTHER DATA											
	1										

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.1565e+003	Th	1.1565e+003	0.0000e+000	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	2.6985e+003	Th	2.6985e+003	-9.0949e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-7.7100e+005	Th	-7.7100e+005	2.3283e-010	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	1.1565e+006	Th	1.1565e+006	-2.3283e-010	-0.0000

vs

Cv Tv ΤvΚ computed value target value Th

Cr

target value kind (theoretical, cross check, accepted).

theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).

accepted value (a value which, on the basis of some argument, can be considered acceptable).

Ac 100(Tv - Cv) / Cv relative error percentage

Computational notes:

Authors: Computed errors:





Problem description:

Beam (both ends fixed) with internal bending moment

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT050		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT050
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [I	mm]		Dx1	l [mm]						Co	onstraints
3000			2	250			-		-	A	s shown
LOAD											
T	уре			1	Value			Po	oint of applic	ation	
NODAL	MOMEN	ΝT		2.0)00e+(007			Dx1		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	E [N/mm ²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005 3.000e-00			1.200e-	005			
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]		J₂[mm ⁴]		J₃ [mi	m⁴]	J	t[mm ⁴]	1	W ₂ [mm ³]	Wa	₃ [mm ³]
1.000e+000	1.0	000e+00)0	0.000e	+000	0.0	00e+000	1	.000e+000	0.0	00e+000
W _{pl2} [mm ³]	W	pl3 [mm ³]]	i₂[m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	0.0	000e+00	00	1.000e	+000	0.0	00e+000	0	.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vK}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-7.5000e+003	Th	-7.5000e+003	1.8190e-012	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	6.2500e+006	Th	6.2500e+006	-1.8626e-009	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	1.0625e+007	Th	1.0625e+007	-1.8626e-009	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	-3.7500e+006	Th	-3.7500e+006	0.0000e+000	-0.0000

vs

Cv Tv TvK	computed value target value target value kind (theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100/The Child Child	Ac relative error pere	accepted value (a value which, on the basis of some argument, can be considered acceptable).
100(10 - C0) / C0	relative error perc	entage
Computational note	NC .	

Computational notes:

Authors: Computed errors:





Problem description:

Beam (both ends fixed) with internal bending moment

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT050BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT050BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		G	EOMETRY 8	CON	STRAIN	ITS																				
Full Length [mm] Dx1 [mm]								(Constraints																	
3000			2250			-		-		As shown																
LOAD																										
	Туре		,	Value			Poir	nt of applica	ation																	
moment	concentra	ated	2.0)00e+0	07			Dx1																		
								-																		
								-																		
								-																		
MATERIAL										Fe360																
f _v [N/mm ²]	f _u [N/m	m²] l	E [N/mm ²]		V	α																				
2.350e+002	3.600e	+002 2	2.060e+005	3.00	0e-001	1.200e-0	005																			
CROSS-SECTIC	N								S	ezione1																
A [mm ²]		J₂[mm ⁴]	J₃ [mi	m⁴]	J _t	[mm ⁴]	W	₂ [mm ³]	٧	V_3 [mm ³]																
1.000e+000	1.	000e+000	0.0006	+000	0.0	00e+000	1.0	00e+000	0.	.000e+000																
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i₂[m	m]	i ₃	i ₃ [mm]		i ₃ [mm]		i ₃ [mm]		i₃ [mm]		i₃ [mm]		i₃ [mm]		i₃ [mm]		i₃ [mm]		i₃ [mm]		[mm]		
1.000e+000	0.	000e+000) 1.000e	+000	0.000e+0		0.0	00e+000																		
OTHER DATA																										

TARGET VALUES vs

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-7.5000e+003	Th	-7.5000e+003	0.0000e+000	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	7.5000e+003	Th	7.5000e+003	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	6.2500e+006	Th	6.2500e+006	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-3.7500e+006	Th	-3.7500e+006	0.0000e+000	-0.0000

Cv	computed value
Tv	target value
TvK	target value kind (the

t value kind (theoretical, cross check, accepted).

ue kind (theor Th the

theoretical value 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(Tv - Cv) / Cv relative error percentage

Computational notes:

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

Cr



TEST SCHEDULE CASTALIA_STAT051		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT051
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Continuous beam (2 spans) with distributed constant load

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT051		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT051
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8	& CON	STRAIN	NTS				
Full Length [mm]									С	onstraints
6000=3000+3	3000			-			-		-	ŀ	\s shown
LOAD											
	Гуре				Value			Po	oint of applic	ation	
force of	distribute	d		2.5	570e+0	00			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		v	α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	Ν									Se	zione 1
A [mm ²]		J₂[mm ⁴]		J₃ [mi	m⁴]	J	J_{t} [mm ⁴]		V₂[mm³]	W	₃ [mm³]
1.000e+000	1.0	000e+00	00	0.000e	+000	0.0	00e+000	1.	000e+000	0.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	0.	000e+00	00	1.000e+000 0.000			00e+000	0.	000e+000		
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vK}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.8913e+003	Th	2.8912e+003	-9.0949e-013	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	4.8188e+003	Th	4.8187e+003	-9.0949e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	-2.8913e+006	Th	-2.8913e+006	0.0000e+000	-0.0000

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage
Computational not	

Computational notes:

Authors: Computed errors:





Problem description:

Continuous beam (2 spans) with internal distributed constant load

- 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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT052		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT052
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		C	GEO	METRY 8		STRAIN	ITS				
Full Length [Full Length [mm] Dx1 [mm]									(Constraints
6000=3000+	3000		3	000			-		-		As shown
LOAD											
-	Гуре			١	Value			Po	oint of applic	ation	
force	distribute	d		2.5	570e+0	00			Left end-Dx	(1	
									-		
									-		
									-		
MATERIAL										Fe360	
f _v [N/mm ²]	f _u [N/m	m²]	E [N	V/mm ²]		v	α				
2.350e+002	3.600e	+002	2.06	60e+005	3.000	De-001	1.200e-0	005			
CROSS-SECTIO	N									S	ezione 1
A [mm ²]		J₂[mm⁴]		J₃ [mr	m⁴]	J	t[mm⁴]	\	V₂[mm³]	٧	V ₃ [mm ³]
1.000e+000	1.	000e+00	0	0.000e	+000	0.0	00e+000	1.	.000e+000	0.	000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i₂ [mı	m]	ia	₃[mm]		i _t [mm]		
1.000e+000	0.	000e+00	0	1.000e	e+000 0.000e+000 0.000e+00			.000e+000			
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.3731e+003	Th	3.3731e+003	-9.0949e-013	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	4.8188e+002	Th	4.8187e+002	-1.7053e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-2.3283e-010	-2.3283e-010	-0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	-1.4456e+006	Th	-1.4456e+006	2.3283e-010	-0.0000

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

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT053		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT053
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Continuous beam (2 spans) with distributed variable load

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT053		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT053
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8		STRAIN	ITS				
Full Length [mm] Dx ⁻				1 [mm]						(Constraints
6000=3000+3000 3			3000			-		-		As shown	
LOAD											
	Туре			,	Value			Po	oint of applica	ation	
force	distribu	ited		2.5	70e+0	00			Left end-Dx	:1	
force	distribu	ited		4.3	60e+0	00			Dx1-Right er	nd	
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N	′mm²]	E [l	N/mm ²]	1	/	α				
2.350e+002	3.60)e+002	2.0	60e+005	3.000)e-001	1.200e-0	005			
CROSS-SECTIO	ON									S	ezione 1
A [mm ²]		J₂[mm⁴]	J₃ [mm⁴]		J	[mm ⁴]	1	W ₂ [mm ³]	V	√ ₃ [mm³]
1.000e+000)	1.000e+	000	0.000e	0.000e+000		00e+000	1	.000e+000	0.	000e+000
$W_{pl2} [mm^3] = W_{pl3} [mm^3]$			i ₂ [mi	m]	ig	[mm]		i _t [mm]			
1.000e+000)	0.000e+	000	1.000e+000 0.00		00e+000	0	.000e+000			
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.5556e+003	Th	2.5556e+003	-9.0949e-013	-0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	5.2406e+003	Th	5.2406e+003	1.8190e-012	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	2.3283e-010	2.3283e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	3.8981e+006	Th	3.8981e+006	9.3132e-010	0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage

Computational notes:

Authors: Computed errors:





Problem description:

Continuous beam (2 spans) with two 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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT054		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT054
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		C	GEC	METRY 8		STRAIN	ITS				
Full Length [mm]		Dx1	l [mm] D			Dx2 [mm]				Constraints
6000=3000+3000 1			1	500			4500		-		As shown
LOAD											
7	Гуре			,	Value			P	oint of application	ation	
NODA	L FORCI	Ε		7.0	00e+0	03			Dx1		
NODA	L FORCI	Ξ		7.0	00e+0	03			Dx2		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/mi	n²]	E [l	N/mm ²]		v	α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	Ν									S	Sezione 1
A [mm ²]		l₂[mm⁴]		J ₃ [mm⁴]		J	t[mm⁴]		W_2 [mm ³]	1	W₃[mm³]
1.000e+000	1.0	000e+00	0	0.000e	+000	0.0	00e+000		1.000e+000	0	.000e+000
W_{pl2} [mm ³] W_{pl3} [mm ³]			i ₂ [mi	m]	ig	3 [mm]		i _t [mm]			
1.000e+000	0.0	000e+00	0 1.000e+000			0.0	00e+000	(0.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 3. Load case # 1	-4.8125e+003	Th	-4.8125e+003	-9.0949e-013	0.0000
Shear T3, I extreme. Beam # 4. Load case # 1	-2.1875e+003	Th	-2.1875e+003	0.0000e+000	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-1.7462e-009	-1.7462e-009	-0.0000
Bending M2, J extreme. Beam # 3. Load case # 1	3.9375e+006	Th	3.9375e+006	9.3132e-010	0.0000

vs

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

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT054BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT054BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Continuous beam (2 spans) with two 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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT054BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT054BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©

GEOMETRY & CONSTRAINTS										7
Full Length [mm] Dx1 [mm]					Dx2 [mm]				С	onstraints
6000=3000-	-3000		1500			4500		-	A	s shown
LOAD										
	Туре			Value			Poir	nt of applic	ation	
force of	oncentra	ed	7.0)00e+(003			Dx1		
force of	oncentra	ed	7.0)00e+(003			Dx2		
								-		
								-		
MATERIAL										Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²]		V	α				
2.350e+002	3.600e	+002 2	2.060e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIO	ON								Se	zione 1
A [mm ²]		J₂[mm⁴]	J₃[m	m⁴]	J	J _t [mm ⁴]		₂ [mm ³]	W	₃[mm ³]
1.000e+000) 1.	000e+000	0.0006	e+000	0.0	00e+000	1.0	00e+000	0.0	00e+000
W_{pl2} [mm ³]	W	/ _{pl3} [mm ³]	i₂[m	m]	ig	3 [mm]	i	t[mm]		
1.000e+000) 0.	000e+000	1.000€	1.000e+000 0.0		00e+000	0.0	00e+000		
OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, J extreme. Beam # 2. Load case # 1	2.1875e+003	Th	2.1875e+003	0.0000e+000	0.0000
Shear T3, I extreme. Beam # 1. Load case # 1	2.1875e+003	Th	2.1875e+003	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	3.9375e+006	Th	3.9375e+006	0.0000e+000	0.0000

vs

Cv	computed value
Tv	target value
TvK	target value kind

nd (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). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac

100(Tv - Cv) / Cv relative error percentage

Computational notes:

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



TEST	SCHEDULE CASTALIA_STAT055		
	SOLVING	BEAM PROBLEM	SOL.SAR.STAT055
	FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



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Continuous beam (2 spans, ends fixed) with distributed constant load

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT055 SOLVING BEAM PROBLEM SOL.SAR.STAT055 FINITE ELEMENT SOLVER CLEVER (SARGON ©)

			GEC	METRY 8		ISTRAII	NTS				
Full Length [r	Ill Length [mm]									(Constraints
6000=3000+3	3000			-			-		-		As shown
LOAD											
Т	уре			,	Value			Po	int of applic	ation	
force d	listribute	b		2.5	570e+0	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/mı	n²]	E [l	N/mm ²]		V	α				
2.350e+002	3.600e-	-002	2.0	60e+005	3.00	00e-001	1.200e-	005			
CROSS-SECTION	Ν									S	ezione 1
A [mm ²]	J	l₂[mm⁴]		J₃ [mr	m⁴]	J	t[mm ⁴]	١	V₂[mm³]	٧	V ₃ [mm ³]
1.000e+000	1.(000e+0	00	0.000e	+000	0.0)00e+000	1.	000e+000	0.	000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³	3]	i₂[mı	m]	i	₃[mm]		i _t [mm]		
1.000e+000	0.0	000e+0	00	1.000e+000		0.0	000e+000	0.	000e+000		
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	3.8550e+003	Th	3.8550e+003	-9.0949e-013	-0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	3.8550e+003	Th	3.8550e+003	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.9275e+006	Th	-1.9275e+006	-4.6566e-010	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.9275e+006	Th	1.9275e+006	-2.3283e-010	-0.0000

Cv Tv TvK	computed value target value 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).
100(Ty) (Cy) (Cy)	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable).
100(10 - C0) / C0	relative error percentage

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT056		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT056
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)
2.57 kN/ m	2.57 k	N/ m
+4.33687 kN +0.481875 k -3.37312 kN	2.40937 kN m 0.9 N 1 .24966	6375 kN m kN m 0.481875 kN m

Problem description:

Continuous beam (2 spans, ends fixed) with one internal distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT056		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT056
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		C	GEO	METRY 8		STRAIN	ITS				
Full Length [mm]		Dx1	[mm]						(Constraints
6000=3000+	3000		3	000			-		-		As shown
LOAD											
-	Гуре			Ň	Value			Po	oint of applic	ation	
force	distribute	d		2.5	570e+0	00			Left end-Dx	(1	
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N	V/mm ²]		v	α				
2.350e+002	3.600e	+002	2.06	60e+005	3.000	De-001	1.200e-0	005			
CROSS-SECTIO	N									S	ezione 1
A [mm ²]		J₂[mm⁴]		J₃ [mr	m⁴]	J	J _t [mm ⁴]		V₂[mm ³]	٧	V ₃ [mm ³]
1.000e+000	1.	000e+00	0	0.000e	+000	0.0	00e+000	1.	.000e+000	0.	000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i₂ [mı	m]	ia	₃[mm]		i _t [mm]		
1.000e+000	0.	000e+00	0	1.000e+000		0.0	0.000e+000		.000e+000		
OTHER DATA											

TARGET VALUES	/S
---------------	----

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	4.3369e+003	Th	4.3369e+003	-9.0949e-013	-0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	-4.8188e+002	Th	-4.8187e+002	1.1369e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-2.4094e+006	Th	-2.4094e+006	-4.6566e-010	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	-4.8188e+005	Th	-4.8187e+005	5.8208e-011	-0.0000

Cv Tv TvK	computed value target value target value kind (1	theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
$100(T_{V} - C_{V}) / C_{V}$	Ac relative error perce	accepted value (a value which, on the basis of some argument, can be considered acceptable).
		shage

Computational notes:

Authors: Computed errors:





Problem description:

Continuous beam (3 spans) with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT057		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT057
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAI	NTS						
Full Length [I	Full Length [mm]									С	onstraints		
9000=3x30	00			-			-		-	ŀ	∖s shown		
LOAD													
T	уре				Value			Р	oint of applica	ation			
force of	distribute	d		2.5	570e+	000			-				
									-				
									-				
									-				
MATERIAL											Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		v	α						
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	00e-001	1.200e-	005					
CROSS-SECTIO	Ν									Se	zione 1		
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm ⁴]		W ₂ [mm ³]	W	₃ [mm ³]		
1.000e+000	1.0	000e+00	0	0.000e	+000	0.0	00e+000	1	.000e+000	0.0	00e+000		
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i ₂ [m	m]	i,	₃[mm]		i _t [mm]				
1.000e+000	0.0	000e+00	0	1.000e+000 0.000e+000 0.000e+000									
OTHER DATA													

TARGET VALUES

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	3.0840e+003	Th	3.0840e+003	-9.0949e-013	-0.0000
Shear T3, I extreme. Beam # 3. Load case # 1	4.6260e+003	Th	4.6260e+003	-9.0949e-013	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	2.3130e+006	Th	2.3130e+006	4.6566e-010	0.0000
Bending M2, J extreme. Beam # 3. Load case # 1	0.0000e+000	Th	-2.3283e-010	-2.3283e-010	-0.0000

vs

Cv Tv TvK	computed value target value target value kind (t	heoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100(Tv – Cv) / Cv	Ac relative error perce	accepted value (a value which, on the basis of some argument, can be considered acceptable). Intage
Computational note		

Computational notes:

Authors: Computed errors:





Problem description:

Continuous beam (3 spans) with 2 internal distributed constant loads

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:

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Note:



TEST SCHEDULE CASTALIA_STAT058		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT058
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAII	NTS						
Full Length [r	Ill Length [mm]									(Constraints		
9000=3x30	00			-			-		-		As shown		
LOAD													
Т	уре			,	Value			Po	int of application	ation			
force of	listribute	d		2.5	570e+	000		First	and second	spans	\$		
									-				
									-				
									-				
MATERIAL											Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α						
2.350e+002	3.600e-	+002	2.0	60e+005	3.0	00e-001	1.200e-	005					
CROSS-SECTIO	Ν									Se	ezione 1		
A [mm ²]		l₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm ⁴]	٧	V ₂ [mm ³]	W	/ ₃ [mm³]		
1.000e+000	1.0	000e+00	0	0.000e	+000	0.0)00e+000	1.	000e+000	0.0	000e+000		
W _{pl2} [mm ³]	W	pl3 [mm ³]		i ₂ [m	m]	i	₃[mm]		i _t [mm]				
1.000e+000	0.0	000e+00	0	1.000e+000 0.000e+000 0.000e+000									
OTHER DATA													

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.9555e+003	Th	2.9555e+003	-9.0949e-013	-0.0000
Shear T3, I extreme. Beam # 3. Load case # 1	2.5700e+002	Th	2.5700e+002	-1.1369e-013	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	7.7100e+005	Th	7.7100e+005	-2.3283e-010	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	2.6985e+006	Th	2.6985e+006	0.0000e+000	0.0000

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

Computational notes:

Authors: Computed errors:





Problem description:

Continuous beam (3 spans) with one internal distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT059		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT059
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAIN	NTS						
Full Length [Full Length [mm]									С	onstraints		
9000=3x30	00			-			-		-	ŀ	As shown		
LOAD													
1	Гуре				Value			Pc	int of application	ation			
force of	distribute	d		2.5	570e+	000			Central spa	In			
									-				
									-				
									-				
MATERIAL											Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²]		V	α							
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	00e-001	1.200e-0	005					
CROSS-SECTIO	Ν									Se	zione 1		
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm⁴]	V	V₂[mm³]	W	₃ [mm ³]		
1.000e+000	1.0	000e+00	0	0.000e	+000	0.0	00e+000	1.	000e+000	0.0	00e+000		
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i ₂ [m	m]	i	₃[mm]		i _t [mm]				
1.000e+000	0.0	000e+00	le+000 1.000e+000 0.000e+000 0.000e+000										
OTHER DATA													

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-3.8550e+002	Th	-3.8550e+002	0.0000e+000	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	3.8550e+003	Th	3.8550e+003	-4.5475e-013	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.1565e+006	Th	1.1565e+006	-4.6566e-010	-0.0000
Bending M2, J extreme. Beam # 3. Load case # 1	0.0000e+000	Th	1.1642e-010	1.1642e-010	0.0000

vs

Cv Tv TvK	computed value target value target value kind (theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100(Tv – Cv) / Cv	Ac relative error perc	accepted value (a value which, on the basis of some argument, can be considered acceptable). entage
Computational note	ic.	

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_ST	AT060		
SOLVING	BEA	M PROBLEM	SOL.SAR.STAT060
FINITE ELEMENT		SOLVER	CLEVER (SARGON ©)
2.57 kN/ m 2.	57 kN/ m	2.57 kN/ m	2.57 kN/ m



Problem description:

Continuous beam (3 spans) with two internal distributed constant loads

- 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:

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Note:



TEST SCHEDULE CASTALIA_STAT060		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT060
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	[mm]									C	onstraints
9000=3x3	3000			-			-		-	Α	s shown
LOAD											
	Туре			,	Value			Р	oint of applica	ation	
force	distribute	ed		2.5	570e+	000			First span		
force	distribute	ed		2.5	570e+	000			Third span		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m ²]	E [I	N/mm ²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005 3.000e-		00e-001	1.200e-0	005			
CROSS-SECTIO	N									Se	zione 1
A [mm ²]		J₂[mm⁴]		J_3 [mm ⁴]		J	t[mm⁴]		W₂[mm³]	W;	₃[mm³]
1.000e+000	1.	000e+0	000	0.000e	+000	0.0	00e+000	1	.000e+000	0.0	00e+000
W _{pl2} [mm ³]	N	V _{pl3} [mm ³]		i ₂ [m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	0.	000e+0	000e+000 1.000		+000	0.0	00e+000	C	.000e+000		
OTHER DATA	OTHER DATA										

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.4695e+003	Th	3.4695e+003	-9.0949e-013	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-4.5475e-013	-4.5475e-013	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.1565e+006	Th	1.1565e+006	2.3283e-010	0.0000
Bending M2, J extreme. Beam # 3. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

vs

Cv Tv TvK	computed value target value target value kind ((theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100/Tex 0: 0 / 0:	Ac	accepted value (a value which, on the basis of some argument, can be considered acceptable).
100(10 – CV) / CV	relative error perc	entage
Computational note	NC '	

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT061		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT061
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Continuous beam (3 spans, ends fixed) with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT061		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT061
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [mm]	nm]								С	onstraints
9000=3x30	00			-			-		-	A	s shown
LOAD											
1	Гуре				Value			P	oint of applic	ation	
force of	distribute	d		2.5	570e+	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	[N/mm ²]		v	α				
2.350e+002	3.600e	+002	2.0	060e+005 3.000e-001		00e-001	1.200e-0	005			
CROSS-SECTIO	Ν									Se	zione 1
A [mm ²]		J₂[mm⁴]		J_3 [mm ⁴]		J	t[mm⁴]		W_2 [mm ³]	W	₃[mm ³]
1.000e+000	1.	000e+00	0	0.000e	+000	0.0	00e+000		1.000e+000	0.0	00e+000
W _{pl2} [mm ³]	W	W _{pl3} [mm ³]		i ₂ [m	m]	i,	₃[mm]		i _t [mm]		
1.000e+000	0.	0.000e+000		1.000e+000		0.0	0.000e+000		0.000e+000		
OTHER DATA	OTHER DATA										

TARGET VALUES vs **COMPUTED VALUES**

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.8550e+003	Th	3.8550e+003	-9.0949e-013	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	3.8550e+003	Th	3.8550e+003	-9.0949e-013	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.9275e+006	Th	1.9275e+006	2.3283e-010	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.9275e+006	Th	-1.9275e+006	-4.6566e-010	0.0000

Cv Tv TvK	computed value target value target value kind	(theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100(Tv – Cv) / Cv	Ac relative error perc	accepted value (a value which, on the basis of some argument, can be considered acceptable). entage
Computational note	<i>.</i>	

Computational notes:

Authors: Computed errors:





Problem description:

Continuous beam (3 spans, ends fixed) with two internal distributed constant loads

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:

Pictures 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:


TEST SCHEDULE CASTALIA_STAT062		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT062
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAII	NTS					
Full Length [mm]										(Constraints	
9000=3x30	00			-			-		-		As shown	
LOAD												
Т	уре			,	Value			Po	oint of application	ation		
force of	listribute	d		2.5	570e+	000		First	and second	spans	\$	
									-			
									-			
									-			
MATERIAL											Fe360	
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		v	α					
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	00e-001	1.200e-	005				
CROSS-SECTIO	Ν									S	ezione 1	
A [mm ²]		l₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm⁴]	1	N ₂ [mm ³]	۷	/ ₃[mm³]	
1.000e+000	1.0	000e+00	0	0.000e	+000	0.0)00e+000	1	.000e+000	0.	000e+000	
W _{pl2} [mm ³]	W	pl3 [mm ³]		i ₂ [m	m]	i	₃[mm]		i _t [mm]			
1.000e+000	0.0).000e+000 1.000e+000			+000	0.000e+000 0.000e+00		.000e+000				
OTHER DATA												

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.7265e+003	Th	3.7265e+003	-9.0949e-013	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	4.2405e+003	Th	4.2405e+003	-9.0949e-013	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.0280e+006	Th	1.0280e+006	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.7990e+006	Th	-1.7990e+006	-4.6566e-010	0.0000

vs

Cv Tv TvK	computed value target value target value kind (theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100(Tv – Cv) / Cv	Ac relative error perc	accepted value (a value which, on the basis of some argument, can be considered acceptable). entage
Computational note	ic.	

Computational notes:

Authors: Computed errors:





Problem description:

Continuous beam (3 spans, ends fixed) with two internal distributed constant loads

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:

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Note:



TEST SCHEDULE CASTALIA_STAT063		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT063
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAIN	ITS					
Full Length	h [mm]									Constraints		
9000=3x3	000			-			-		-		As shown	
LOAD												
	Туре			1	Value			P	oint of application	ation		
force	distribute	d		2.5	570e+0	000			First span			
force	distribute	d		2.5	570e+0	000			Third span	۱		
									-			
	-											
MATERIAL											Fe360	
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm ²]		v	α					
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-	005				
CROSS-SECTIO	DN									S	ezione 1	
A [mm ²]		J₂[mm⁴]		J₃ [mr	n⁴]	J	J _↑ [mm ⁴]		W ₂ [mm ³]	/	<i>N</i> ₃ [mm ³]	
1.000e+000) 1.	000e+00	0	0.000e	+000	0.0	00e+000		1.000e+000	0	.000e+000	
W _{pl2} [mm ³]	W	_{pl3} [mm ³		i₂[mı	m]	ig	3 [mm]		i _t [mm]			
1.000e+000	0.	000e+00)0 1.000e+000			0.0	00e+000	(0.000e+000			
OTHER DATA												

TARGET	VALUES
--------	--------

COMPUTED VALUES

Description	Τ _ν	T_{vK}	C _v	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	4.4975e+003	Th	4.4975e+003	0.0000e+000	0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-1.1369e-013	-1.1369e-013	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	6.4250e+005	Th	6.4250e+005	3.4925e-010	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-2.5700e+006	Th	-2.5700e+006	-9.3132e-010	0.0000

vs

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

Computational notes:

Authors: Computed errors:





Problem description:

Continuous beam (3 spans, ends fixed) with one internal distributed constant loads

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:

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Note:



TEST SCHEDULE CASTALIA_STAT064		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT064
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAI	NTS					
Full Length [I	mm]									С	onstraints	
9000=3x30	00			-			-		-	A	s shown	
LOAD												
T	уре				Value			Po	pint of application	ation		
force of	distribute	d		2.5	570e+	000			Central spa	n		
									-			
									-			
									-			
MATERIAL											Fe360	
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α					
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	00e-001	1.200e-	005				
CROSS-SECTIO	Ν									Se	zione 1	
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm ⁴]	1	W₂[mm ³]	W	₃[mm³]	
1.000e+000	1.0	000e+00	0	0.000e	+000	0.0	00e+000	1	.000e+000	0.0	00e+000	
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i ₂ [m	m]	i,	₃[mm]		i _t [mm]			
1.000e+000	0.0	0.000e+000 1.000e+00			+000	0.000e+000 0.000e+00		.000e+000				
OTHER DATA												

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-6.4250e+002	Th	-6.4250e+002	-2.2737e-013	0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	3.8550e+003	Th	3.8550e+003	-9.0949e-013	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.2850e+006	Th	1.2850e+006	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	6.4250e+005	Th	6.4250e+005	3.4925e-010	0.0000

vs

Cv Tv TvK	computed value target value target value kind (theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100(Tv – Cv) / Cv	Ac relative error perc	accepted value (a value which, on the basis of some argument, can be considered acceptable). entage
Computational note	s.	

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT065		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT065
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Continuous beam (4 spans) with distributed constant load

- 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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT065		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT065
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8		STRAIN	NTS				
Full Length [С	onstraints			
12000=4x30	000			-			-		-	A	As shown
LOAD											
	Гуре				Value			Po	oint of applic	ation	
force of	distribute	d		2.5	570e+0	00			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		v	α				
2.350e+002	3.600e-	+002	2.0	060e+005 3.000e-001		1.200e-0	005				
CROSS-SECTIO	Ν									Se	zione 1
A [mm ²]		J₂[mm ⁴]		J_3 [mm ⁴]		J	J_t [mm ⁴]		N ₂ [mm ³]	W	₃ [mm ³]
1.000e+000	1.0	000e+00)0	0.000e	+000	0.0	0.000e+000		.000e+000	0.0	00e+000
W _{pl2} [mm ³]	W _{pl2} [mm ³] W _{pl3} [mm ³]			i ₂ [mm]		i	₃[mm]		i _t [mm]		
1.000e+000 0.000e+000			1.000e	+000	0.0	00e+000	0.	.000e+000			
OTHER DATA	OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.0289e+003	Th	3.0289e+003	-4.2857e-004	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	4.1304e+003	Th	4.1304e+003	1.4286e-004	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.6521e+006	Th	1.6521e+006	-1.4286e-001	-0.0000
Bending M2, I extreme. Beam # 4. Load case # 1	-2.4782e+006	Th	-2.4782e+006	-2.8571e-001	0.0000

vs

Cv Tv TvK	computed value target value target value kind (1	theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
$100(T_{V} - C_{V}) / C_{V}$	Ac relative error perce	accepted value (a value which, on the basis of some argument, can be considered acceptable).
		shage

Computational notes:

Authors: Computed errors:





Problem description:

Simply supported beam with internal inclined force

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:

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Note:



TEST SCHEDULE CASTALIA_STAT066		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT066
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	ull Length [mm] alph			ia [deg]			Dx1 [mm]			C	Constraints
3000				45°			1000		-		As shown
LOAD											
	Туре				Value	;		Po	int of applic	ation	
NODA	AL FORC	E		7.0	00e+	003			Dx1		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.0	00e-001	1.200e-0	005			
CROSS-SECTIO	N									I	PE200
A [mm ²]	,	J₂[mm⁴]		J₃ [mm⁴]		J	t[mm⁴]	٧	V ₂ [mm ³]	N	/ ₃ [mm ³]
2.981e+003	2.	051e+00	7	1.540e	+006	6.2	254e+004	2.	051e+005	3.0)81e+004
W _{pl2} [mm ³] W _{pl3} [mm ³]				i₂[mı	m]	i,	₃[mm]		i _t [mm]		
2.597e+005 4.776e+004		8.296e	+001	2.2	273e+001	2.	887e+001				
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.2998e+003	Th	3.2998e+003	3.5400e-004	0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	-1.6499e+003	Th	-1.6499e+003	-1.7700e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-1.3970e-009	-1.3970e-009	-0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	3.2998e+006	Th	3.2998e+006	3.5400e-001	0.0000

vs

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

Computational notes:

Authors: Computed errors:





Problem description:

Simply supported beam with internal inclined force

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:

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.

Note:

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

Note:



TEST SCHEDULE CASTALIA_STAT066BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT066BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS										
Full Length	[mm]	alp	alpha [deg] Dx1 [mm			Dx1 [mm]			Co	nstraints
3000			45°			1000		-	As	s shown
LOAD										
	Туре			Value			Poi	nt of applica	ation	
force c	oncentrat	ed	4.9	950e+0	003			Dx1		
force c	oncentrat	ed	4.9	950e+0	003			Dx1		
								-		
	-									
MATERIAL	ERIAL									Fe360
f _v [N/mm ²]	f _u [N/mi	n²] E	[N/mm ²]		V	α				
2.350e+002	3.600e-	-002 2.	060e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	ON								IP	E200
A [mm ²]		l₂[mm⁴]	J₃[mi	m⁴]	J _↑ [mm ⁴]		W	2 [mm ³]	W ₃	[mm ³]
2.981e+003	2.0	051e+007	1.540e	+006	6.2	54e+004	004 2.051e+00		3.08	1e+004
W_{pl2} [mm ³]	W	_{pl3} [mm ³]	i₂[m	m]	ia	₃[mm]	i	i _t [mm]		
2.597e+005	4 .7	4.776e+004 8.296e+0			2.273e+001 2.887e+00			87e+001		
OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.2998e+003	Th	3.2998e+003	5.1899e-004	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	1.6499e+003	Th	1.6499e+003	1.2008e-005	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-6.9849e-010	-6.9849e-010	-0.0000

vs

Cv	computed value
Tv	target value
TvK	target value kind (theore

etical, cross check, accepted).

Th

theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable).

Ac

100(Tv - Cv) / Cv relative error percentage

Computational notes:

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

Cr





Problem description:

Simply supported beam with inclined distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT067		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT067
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8		ISTRAI	NTS				7	
Full Length [mm]		alph	a [deg]						Co	onstraints	
3000				45°					-	A	s shown	
LOAD												
-	Туре			,	Value			P	pint of application	ation		
force linea	arly distril	outed		2.5	570e+	000			-			
									-			
									-			
									-			
MATERIAL											Fe360	
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²]			V	α					
2.350e+002	3.600e	+002	2.0	60e+005	3.00	00e-001	1.200e-0	005				
CROSS-SECTIO	N									IP	E200	
A [mm ²]		J₂[mm ⁴]		J₃ [mi	m⁴]	J	J_t [mm ⁴]		W ₂ [mm ³]	Wa	յ [mm³]	
2.981e+003	2.	051e+00)7	1.540e	+006	6.2	254e+004	2	.051e+005	3.0	81e+004	
W _{pl2} [mm ³]	W	′ _{pl3} [mm ³]	i₂[m	m]	i	₃[mm]		i _t [mm]			
2.597e+005	5 4.776e+004		8.296e	8.296e+001		273e+001	2	.887e+001				
OTHER DATA												

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.7259e+003	Th	2.7259e+003	-6.4100e-004	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	2.7259e+003	Th	2.7259e+003	-6.4100e-004	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	4.6566e-010	4.6566e-010	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage
Computational note	

Computational notes:

Authors: Computed errors:





Problem description:

Supported cantilever, right bearing translational settle

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:

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Note:



TEST SCHEDULE CASTALIA_STAT068		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT068
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	OMETRY 8		ISTRAIN	ITS				
Full Length	[mm]									(Constraints
3000				-			-		-		As shown
LOAD											
	Туре			,	Value			Р	oint of applica	ation	
	Settle			2	50mm	1			Right end		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	N									S	ezione1
A [mm ²]		J₂[mm⁴]		J₃ [mr	n⁴]	J	t[mm⁴]		W ₂ [mm ³]	۷	V ₃ [mm ³]
1.000e+000	1.	000e+00	0	1.000e	+000	1.0	00e+000	1	.000e+000	1.	000e+000
W _{pl2} [mm ³]	W	W _{pl3} [mm ³]		i ₂ [mı	m]	i;	3 [mm]		i _t [mm]		
1.000e+000	1.	1.000e+000		1.000e	+000	1.0	00e+000	1	.000e+000		
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	5.7222e-003	Th	5.7222e-003	2.9666e-010	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	-5.7222e-003	Th	-5.7222e-003	-2.9666e-010	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.7167e+001	Th	-1.7167e+001	-2.1999e-007	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	7.1054e-015	7.1054e-015	0.0000

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

Computational notes:

Authors: Computed errors:





Problem description:

Supported cantilever, clamping rotational settle

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:

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Note:



TEST SCHEDULE CASTALIA_STAT069		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT069
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		(GEC	METRY 8	CON	STRAIN	NTS					
Full Length	mm]							(Constraints			
3000				-			-		-		As shown	
LOAD												
	Туре			,	Value			Po	pint of application	ation		
	Settle			(),3rad				Left end			
									-			
									-			
									-			
MATERIAL										Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²]		V	α					
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005				
CROSS-SECTIO	N									S	ezione1	
A [mm ²]		J₂[mm⁴]		J₃ [mr	n⁴]	J	t[mm⁴]	1	W₂[mm ³]	V	/ ₃ [mm ³]	
1.000e+000	1.	000e+00)0	1.000e	+000	1.0	00e+000	1	.000e+000	1.0	000e+000	
W_{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [mi	m]	i	₃[mm]		i _t [mm]			
1.000e+000	1.	1.000e+000			+000	1.0	00e+000	1	.000e+000			
OTHER DATA	OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vK}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-2.0600e-002	Th	-2.0600e-002	-2.6798e-010	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	2.0600e-002	Th	2.0600e-002	2.6798e-010	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	6.1800e+001	Th	6.1800e+001	8.0394e-007	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000

vs

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

Computational notes:

Authors: Computed errors:





Problem description:

Fully restrained beam. Left clamping translational settle.

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:

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Note:



TEST SCHEDULE CASTALIA_STAT070 SOLVING BEAM PROBLEM SOL.SAR.STAT070 FINITE ELEMENT SOLVER CLEVER (SARGON ©)

		(GEC	METRY 8		ISTRAII	NTS						
Full Length [mm]										Constraints		
3000				-			-		-		As shown		
LOAD													
1	Гуре				Value			F	oint of applic	ation			
S	Settle			2	50mn	ı			Right end				
									-				
									-				
									-				
MATERIAL										Fe360			
f _v [N/mm ²]	f _u [N/m	m²]	E [I	N/mm²]		V	α						
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	00e-001	1.200e	-005					
CROSS-SECTIO	Ν									S	Sezione1		
A [mm ²]	,	J₂[mm⁴]		J₃ [mm ⁴]		J	t[mm⁴]		W ₂ [mm ³]	\	<i>N</i> ₃ [mm ³]		
1.000e+000	1.0	000e+00	00	1.000e	+000	1.0)00e+000		1.000e+000	1	.000e+000		
W _{pl2} [mm ³]	W	pl3 [mm ³]]	i ₂ [m	m]	i	₃[mm]		i _t [mm]				
1.000e+000	00e+000 1.000e+000 1.000e+0				+000	1.0)00e+000		1.000e+000				
OTHER DATA													

TARGET VALUES vs C

COMPUTED VALUES

Description	T _v	Т _{vK}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	2.2889e-002	Th	2.2889e-002	-1.1132e-010	-0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	-2.2889e-002	Th	-2.2889e-002	1.1132e-010	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-3.4333e+001	Th	-3.4333e+001	-3.0190e-009	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	-3.4333e+001	Th	-3.4333e+001	-3.0190e-009	0.0000

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

Computational notes:

Authors: Computed errors:





Problem description:

Fully restrained beam. Right clamping rotational settle.

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:

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Note:



TEST SCHEDULE CASTALIA_STAT071		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT071
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		Ģ	θEO	METRY 8	k CON	STRAIN	NTS						
Full Length [mm]									C	Constraints		
3000				-			-		-		As shown		
LOAD													
1	Гуре			,	Value			Pc	int of application	ation			
	Settle			(),3rad				Left end				
									-				
									-				
									-				
MATERIAL											Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α						
2.350e+002	3.600e	+002	2.06	060e+005 3.000		0e-001	1.200e-0	005					
CROSS-SECTIO	Ν									S	ezione1		
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm⁴]	V	V₂[mm³]	W	/ ₃ [mm ³]		
1.000e+000	1.	000e+00	0	1.000e	+000	1.0	00e+000	1.	000e+000	1.0	000e+000		
W _{pl2} [mm ³]	W	′ _{pl3} [mm ³]		i₂[m	m]	i	₃[mm]		i _t [mm]				
1.000e+000	1.000e+000 1.000e+000					1.0	00e+000	1.	000e+000				
OTHER DATA													

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-4.1200e-002	Th	-4.1200e-002	-5.3596e-010	0.0000
Shear T3, J extreme. Beam # 1. Load case # 1	4.1200e-002	Th	4.1200e-002	5.3596e-010	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	8.2400e+001	Th	8.2400e+001	1.0719e-006	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	4.1200e+001	Th	4.1200e+001	5.3596e-007	0.0000

Cv Tv TvK	computed value target value target value kind (1	theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100(Tv – Cv) / Cv	Ac relative error perce	accepted value (a value which, on the basis of some argument, can be considered acceptable). entage
Computational note		

Computational notes:

Authors: Computed errors:





Problem description:

Hinged frame with constant distributed load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT072		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT072
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8	k COI	NSTRAI	NTS						
Full Length	[mm]	Fu	ıll He	eight [mm]						C	constraints		
3000			4	-000			-		-		As shown		
LOAD													
	Туре				Value)		P	oint of applic	ation			
force	distribute	d		2.5	570e+	000			-				
									-				
									-				
									-				
MATERIAL											Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm ²]		V	α						
2.350e+002	3.600e	+002	2.0	60e+005	3.0	00e-001	1.200e-	005					
CROSS-SECTIC	N									Se	zione1		
A [mm ²]		J₂[mm⁴]		J₃ [mr	m⁴]	J	t[mm ⁴]	1	W ₂ [mm ³]	W	/ ₃ [mm ³]		
1.000e+000	1.	000e+0	00	1.000e	+000) 1.0	00e+000	1	.000e+000	1.0)00e+000		
$W_{pl2} [mm^3]$	W	_{pl3} [mm	3]	i ₂ [mi	m]	i,	₃[mm]		i _t [mm]				
1.000e+000	+000 1.000e+000 1.000e+00				+000	1.0	00e+000	1	.000e+000				
OTHER DATA													

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vK}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-2.5511e+002	Th	-2.5511e+002	8.4235e-006	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, I extreme. Beam # 3. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.0204e+006	Th	1.0204e+006	-3.3294e-002	-0.0000

vs

Cv Tv TvK	computed value target value target value kind (the	eoretical, cross check, accepted).
	Th t Cr c	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
$100(T_{V} - C_{V}) / C_{V}$	Ac a	accepted value (a value which, on the basis of some argument, can be considered acceptable).
	Telative entit percent	age

Computational notes:

Authors: Computed errors:





Problem description:

Hinged frame with shear force

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:

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Note:



TEST SCHEDULE CASTALIA_STAT073 SOLVING BEAM PROBLEM FINITE ELEMENT SOLVER CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [Full Length [mm] Full Heig				eight [mm]			Dx1 [mm]			Constraints
3000			4	-000			1000		-		As shown
LOAD											
	Гуре			,	Value			F	oint of applic	ation	
NODA	L FORC	Ε		7.0	00e+	003			Dx1		
									-		
									-		
									-		
MATERIAL								Fe360			
f _v [N/mm ²]	f _u [N/mi	m²]	E [l	N/mm ²]		V	α	5			
2.350e+002	3.600e-	+002	2.0	60e+005	3.0	00e-001	1.200	e-005			
CROSS-SECTIO	Ν									S	Sezione1
A [mm ²]	J	l₂[mm⁴]		J₃ [mr	m⁴]	J	t[mm ⁴]		W_2 [mm ³]	/	N ₃ [mm ³]
1.000e+000	1.(000e+0	00	1.000e	+000	1.	000e+00	0	1.000e+000	1	.000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm	3]	i₂[mı	m]		i₃ [mm]		i _t [mm]		
1.000e+000	1.0	000e+0	-000 1.000e+00		+000	1.	000e+00	0	1.000e+000		
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-3.0882e+002	Th	-3.0882e+002	1.0260e-005	-0.0000
Shear T3, I extreme. Beam # 4. Load case # 1	3.0882e+002	Th	3.0882e+002	-1.0153e-005	-0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	-1.2353e+006	Th	-1.2353e+006	4.1441e-002	-0.0000
Bending M2, I extreme. Beam # 3. Load case # 1	3.4314e+006	Th	3.4314e+006	4.0965e-002	0.0000

Cv Tv TvK	computed value target value	(theoretical cross shock accepted)
	target value kind	(neoretical, 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(Tv - Cv) / Cv	relative error perc	centage
O		

Computational notes:

Authors: Computed errors:





Problem description:

Hinged frame with shear force

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT073BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT073BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		GI	EOMETRY 8		ISTRAIN	ITS				
Full Length	Full Length [mm] Full He				leight [mm] D>					Constraints
3000			4000			1000		-		As shown
LOAD										
.	Туре			Value			Poi	nt of applic	ation	
force c	oncentrat	ed	7.0)00e+(003			Dx1		
								-		
								-		
	-									
MATERIAL								Fe360		
f _v [N/mm ²]	f _u [N/m	m²] E	E [N/mm ²]		V	α				
2.350e+002	3.600e-	+002 2	.060e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIC	N								:	Sezione1
A [mm ²]		J₂[mm⁴]	J ₃ [mi	m⁴]	J	[mm⁴]	W	₂ [mm ³]		W_3 [mm ³]
1.000e+000	1.	000e+000	1.0006	900+	1.0	00e+000	1.0	00e+000	1	.000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [m	m]	ig	[mm]	i	t [mm]		
1.000e+000	1.	000e+000	1.000e	1.000e+000 1.000		00e+000	1.0	00e+000		
OTHER DATA										

TARGET VALUES vs **COMPUTED VALUES**

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-3.0882e+002	Th	-3.0882e+002	2.5701e-005	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	3.0882e+002	Th	3.0882e+002	-2.5594e-005	-0.0000
Bending M2, I extreme. Beam # 3. Load case # 1	-1.2353e+006	Th	-1.2353e+006	1.0321e-001	-0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000

0.	
CV	computed value
Tv	target value
TvK	target value kind (theoretica

target value kind (theoretical, cross check, accepted).

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

100(Tv - Cv) / Cv relative error percentage

Computational notes:

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

Th

Cr





Problem description:

Hinged frame with horizontal force

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT074		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT074
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	n [mm] Full Height [mm]									Co	onstraints
3000			4	-000					-	A	s shown
LOAD											
	Туре				Value			Р	oint of applica	ation	
NODA	AL FORC	E		7.0	00e+0	03			-		
									-		
									-		
									-		
MATERIAL									Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [I	N/mm²]		v	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	0e-001	1.200e-0	005			
CROSS-SECTIO	N									Sea	zione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	n⁴]	J	t[mm⁴]		W ₂ [mm ³]	W ₃	[mm ³]
1.000e+000	1.	000e+0	00	1.000e	+000	1.0	00e+000	1	.000e+000	1.00)0e+000
$W_{pl2} [mm^3]$	W	_{pl3} [mm	³]	i ₂ [m	m]	ig	₃ [mm]		i _t [mm]		
1.000e+000	1.	000e+0	00	1.000e+000		1.0	00e+000	1	.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 3. Load case # 1	3.5000e+003	Th	3.5000e+003	-1.1227e-004	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-1.4000e+007	Th	-1.4000e+007	-4.7739e-001	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.4000e+007	Th	1.4000e+007	-4.4908e-001	-0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage
0	

Computational notes:

Authors: Computed errors:





Problem description:

Hinged frame with constant distributed load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT075		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT075
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8		ISTRAI	NTS				
Full Length	eight [mm]						С	onstraints			
3000			4	000			-		-	A	\s shown
LOAD											
	Туре			,	Value			P	pint of applic	ation	
force	distribute	d		2.5	570e+	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm ²] <i>v</i>		α					
2.350e+002	3.600e	+002	2.0	60e+005	3.00	00e-001	1.200e-	005			
CROSS-SECTIO	N									Se	zione1
A [mm ²]		J ₂ [mm ⁴]]	J₃ [mi	m⁴]	J	t[mm⁴]	'	W ₂ [mm ³]	W	₃[mm ³]
1.000e+000	1.000e+000 1.000e+000		1.000e	+000	1.(000e+000	1	.000e+000	1.0	00e+000	
W _{pl2} [mm ³] W _{pl3} [mm ³]		າ ³]	i ₂ [m	m]	i	₃[mm]		i _t [mm]			
1.000e+000 1.000e+000			1.000e	+000	1.(000e+000	1	.000e+000			
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	7.4076e+003	Th	7.4076e+003	9.7936e-005	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	3.2596e-009	3.2596e-009	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-9.0706e+006	Th	-9.0706e+006	-3.9274e-001	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.1489e+007	Th	1.1489e+007	-3.6317e-001	-0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Ty – Cy) / Cy	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable).

Computational notes:

Authors: Computed errors:





Problem description:

Hinged portal frame, projecting beam. Constant distributed load.

- 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:

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Note:



TEST SCHEDULE CASTALIA_STAT076		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT076
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8		ISTRAI	NTS				
Full Length [mm] Full Heig				eight [mm] Projecting		ting beam	[mm]			Constraints	
3000			4	000			1000		-		As shown
LOAD											
	Туре			,	Value			Poir	nt of applic	ation	
force	distribute	d		2.5	570e+	000		Pro	ojecting be	am	
									-		
									-		
									-		
MATERIAL								Fe360			
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm ²] <i>v</i>			α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIO	DN									S	Sezione1
A [mm ²]	,	J ₂ [mm ⁴]		J₃ [mi	m⁴]	J	t[mm⁴]	W	2 [mm ³]	\	<i>N</i> ₃ [mm ³]
1.000e+000	1.000e+000 1.0		00	1.000e+00		1.0	00e+000	1.0	00e+000	1.	.000e+000
W _{pl2} [mm ³] W _{pl3} [mm ³]		·]	i ₂ [m	m]	i,	₃[mm]	i ₁	[mm]			
1.000e+000 1.000e+000				1.000e	+000	1.0	00e+000	1.0	00e+000		
OTHER DATA											

TARGET	VALUES	
--------	--------	--

COMPUTED VALUES

Description	T _v	Т _{vK}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	8.5037e+001	Th	8.5037e+001	-2.7735e-006	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-3.4015e+005	Th	-3.4015e+005	1.1054e-002	-0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	-9.4485e+005	Th	-9.4485e+005	-1.1054e-002	0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Ty) (Cy) (Cy)	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable).
100(10 - C0) / C0	relative error percentage

Computational notes:

Authors: Computed errors:



TEST SCHEDULE CASTALIA_STAT077		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT077
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)



Problem description:

Hinged frame with temperature increase

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:

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Note:



TEST SCHEDULE CASTALIA_STAT077		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT077
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8		NSTRAI	NTS				
Full Length [eight [mm]						C	onstraints			
3000			4	-000			-		-	1	As shown
LOAD											
-	Гуре				Value)		P	pint of applic	ation	
tem	oerature			3.0	00e+	·001			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [I	N/mm²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.0	00e-001	1.200e-	005			
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]		l ₂ [mm ⁴]		J₃ [mi	m⁴]	J	t[mm⁴]	1	W ₂ [mm ³]	W	3 [mm ³]
1.000e+000	1.0	000e+0	00	1.000e	+000) 1.(000e+000	1	.000e+000	1.0)00e+000
W _{pl2} [mm ³]	W _{pl2} [mm ³] W _{pl3} [mm ³] i ₂ [r		i₂[m	m]	i	₃[mm]		i _t [mm]			
1.000e+000 1.000e+000		1.000e	+000) 1.0	000e+000	1	.000e+000				
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-2.4538e-006	Th	-2.4538e-006	4.6237e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	9.5410e-018	9.5410e-018	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	9.8153e-003	Th	9.8153e-003	1.5050e-010	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	9.8153e-003	Th	9.8153e-003	1.2960e-010	0.0000

vs

Cv Tv TvK	computed value target value target value kind (the	eoretical, cross check, accepted).
	Th t Cr c	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
$100(T_{V} - C_{V}) / C_{V}$	Ac a	accepted value (a value which, on the basis of some argument, can be considered acceptable).
	relative entit percent	aye

Computational notes:

Authors: Computed errors:





Problem description:

Fixed frame with constant distributed load

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:

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Note:


TEST SCHEDULE CASTALIA_STAT078		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT078
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS																			
Full Length [n [mm] Full Heig			eight [mm]						Co	onstraints								
3000			4	000			-		-	A	s shown								
LOAD																			
-	Туре			1	Value	•		F	Point of applic	ation									
force	distribute	d		2.5	570e+	000			-										
									-										
									-										
									-										
MATERIAL											Fe360								
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α												
2.350e+002	3.600e-	+002	2.0	60e+005	3.0	00e-001	1.200e	-005											
CROSS-SECTIO	N									Se	zione1								
A [mm ²]		l ₂ [mm ⁴]	n^4] J_3 [mm ⁴]		J_3 [mm ⁴]		J₃ [mm⁴]		J₃ [mm⁴]		J₃ [mm⁴]		J₃ [mm⁴]		J _t [mm⁴]		W ₂ [mm ³]	W ₃	[mm ³]
1.000e+000	1.0	000e+0	00	1.000e	+000) 1.	000e+000		1.000e+000	1.00)0e+000								
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [m	m]		i₃ [mm]		i _t [mm]										
1.000e+000	1.0	000e+0	00	1.000e	+000) 1.	000e+000		1.000e+000										
OTHER DATA																			

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-4.3369e+002	Th	-4.3369e+002	6.7086e-005	-0.0000
Shear T3, I extreme. Beam # 3. Load case # 1	4.3369e+002	Th	4.3369e+002	-6.7086e-005	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	5.7825e+005	Th	5.7825e+005	-1.7076e-001	-0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	1.1565e+006	Th	1.1565e+006	-9.7580e-002	-0.0000

vs

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

Computational notes:

Authors: Computed errors:





Problem description:

Fixed frame with constant distributed load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT079		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT079
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEO	METRY 8	k COI	ISTRAII	NTS				
Full Length [ı [mm] Full Hei			eight [mm]						Co	onstraints
3000			4	000			-		-	A	s shown
LOAD											
-	Гуре			,	Value			Р	oint of applic	ation	
force	distribute	d		2.5	570e+	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e-	+002	2.06	60e+005	3.0	00e-001	1.200e-	005			
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm⁴]		W ₂ [mm ³]	Wa	₃ [mm ³]
1.000e+000	1.	000e+00	00	1.000e	+000	1.(000e+000	1	.000e+000	1.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [m	m]	i	₃ [mm]		i _t [mm]		
1.000e+000	1.	000e+00	00	1.000e+000		1.(000e+000	1	.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 2. Load case # 1	2.1845e+003	Th	2.1845e+003	-3.3716e-004	-0.0000
Shear T3, I extreme. Beam # 1. Load case # 1	8.0955e+003	Th	8.0955e+003	3.3867e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-9.4614e+006	Th	-9.4614e+006	-2.0656e+000	0.0000
Bending M2, I extreme. Beam # 3. Load case # 1	2.3606e+006	Th	2.3606e+006	-7.1089e-001	-0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage

Computational notes:

Authors: Computed errors:





Problem description:

Fixed frame with shear force

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT080		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT080
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS												
Full Length [[mm] Full Height			eight [mm] C			Dx1 [mm]			(Constraints	
3000			4	000				1000		-		As shown
LOAD												
-	Туре			,	Value)			Р	oint of applic	ation	
NODA	AL FORC	E		7.0	00e+	003				Dx1		
										-		
										-		
										-		
MATERIAL												Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [ľ	N/mm²]		V		α				
2.350e+002	3.600e-	+002	2.06	60e+005	3.0	00e-00	1	1.200e-0	005			
CROSS-SECTIO	N										S	ezione1
A [mm ²]		J₂[mm⁴]		J₃ [mr	n⁴]	J		[mm ⁴]		W ₂ [mm ³]	۷	V ₃ [mm³]
1.000e+000	1.	000e+00	0	1.000e	+000) 1	.0	00e+000	1	.000e+000	1.	000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i ₂ [mi	m]		i ₃	[mm]		i _t [mm]		
1.000e+000	1.	000e+00	0	1.000e	1.000e+000		.0	00e+000	1	.000e+000		
OTHER DATA												

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-5.2500e+002	Th	-5.2500e+002	8.1147e-005	-0.0000
Shear T3, I extreme. Beam # 3. Load case # 1	5.2500e+002	Th	5.2500e+002	-8.1275e-005	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	6.1358e+005	Th	6.1358e+005	5.1894e-001	0.0001
Bending M2, I extreme. Beam # 2. Load case # 1	-1.4864e+006	Th	-1.4864e+006	8.4342e-001	-0.0001

vs

Cv Tv TvK	computed value target value 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).	
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage	
Commutational nat		

Computational notes:

Authors: Computed errors:





Problem description:

Fixed frame with shear force

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT080BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT080BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS]		
Full Length	[mm]	nm] Full Height [mm]				Dx1 [mm]				onstraints
3000			4000			1000		-	A	s shown
LOAD										
	Туре			Value			Poir	nt of application	ation	
force of	oncentrat	ed	7.0)00e+	003			Dx1		
								-		
								-		
								-		
MATERIAL										Fe360
f _v [N/mm ²]	f _u [N/m	m²] l	E [N/mm ²]		V	α				
2.350e+002	3.600e	+002 2	2.060e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIO	ON								Sea	zione1
A [mm ²]		J₂[mm ⁴]	J₃[m	m⁴]	J	[mm⁴]	W	2 [mm ³]	Wa	[mm ³]
1.000e+000) 1.	000e+000	1.0006	e+000	1.0	00e+000	1.0	00e+000	1.00	00e+000
W_{pl2} [mm ³]	W	_{pl3} [mm ³]	i₂[m	m]	ig	_a [mm]	i _t [mm]			
1.000e+000) 1.	000e+000	1.0006	1.000e+000 1.000		00e+000	1.0	00e+000		
OTHER DATA										

TARGET VALUES vs

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	(C_v-T_v)	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-5.2500e+002	Th	-5.2500e+002	1.0749e-004	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	5.2500e+002	Th	5.2500e+002	-1.0743e-004	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	6.1358e+005	Th	6.1358e+005	4.7076e-001	0.0001
Bending M2, I extreme. Beam # 3. Load case # 1	-1.4864e+006	Th	-1.4864e+006	9.0063e-001	-0.0001

Cv/	
00	
TV	
I V	
Tvk	
1 1 1	

computed value target value

target value kind (theoretical, cross check, accepted).

Th Cr

theoretical value cross check value (theoretical target value is not known, results obtained with a different

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac

100(Tv - Cv) / Cv relative error percentage

Computational notes:

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





Problem description:

Fixed portal frame, projecting beam. Constant distributed load.

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT081		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT081
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	[mm] Full Height [i			eight [mm]	mm] Projecting beam [mm]			mm]		С	onstraints
3000			4	000			1000		-	A	As shown
LOAD											
	Туре			,	Value			Poi	nt of applic	ation	
force	distribute	d		2.5	570e+	000		Р	rojecting bea	am	
									-		
									-		
									-		
MATERIAL							Fe360				
f _v [N/mm ²]	f _u [N/m	m²]	E [l	[N/mm ²] v		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005 3.000e-001		1.200e-	005				
CROSS-SECTIC	N									Se	zione1
A [mm ²]		J₂[mm⁴]		J ₃ [mm⁴]		J	t[mm ⁴]	W	2 [mm ³]	W	₃ [mm ³]
1.000e+000	1.	000e+0	00	1.000e	+000	1.000e+000		1.0	00e+000	1.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm	³]	i₂[m	m]	i	₃[mm]	i	t[mm]		
1.000e+000	1.	1.000e+000 1.0		1.000e	+000	1.0	00e+000	1.0	00e+000		
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.4456e+002	Th	1.4456e+002	-2.2388e-005	-0.0000
Shear T3, I extreme. Beam # 3. Load case # 1	-1.4456e+002	Th	-1.4456e+002	2.2336e-005	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.2136e+005	Th	-1.2136e+005	1.0441e+000	-0.0009
Bending M2, I extreme. Beam # 3. Load case # 1	2.6414e+005	Th	2.6414e+005	9.3023e-001	0.0004

Cv Tv TvK	computed value target value target value kind (theoretical, cross check, accepted)	
IVK	Th theoretical value Cr cross check value (theoretical target value is not known, results obtained with program are used as target values).	a different
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be consid relative error percentage	ered acceptable).
o		

Computational notes:

Authors: Computed errors:





Problem description:

Fixed frame with horizontal force

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:

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Note:



TEST SCHEDULE CASTALIA_STAT082		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT082
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [mm]] Full Height [mm]								C	onstraints
3000			4	000			-		-		As shown
LOAD											
-	Гуре			1	Value	;		Po	oint of applic	ation	
NODA	L FORC	E		7.0)00e+	-003			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	[N/mm ²] v		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005 3.000e-001		1.200e-	005				
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]	,	J₂[mm ⁴]		J₃ [mi	m⁴]	J	J _↑ [mm ⁴]		W ₂ [mm ³]	W	₃[mm³]
1.000e+000	1.0	000e+0	00	1.000e	+000) 1.()00e+000	1	.000e+000	1.0)00e+000
W _{pl2} [mm ³]	W	/ _{pl3} [mm ³]		i₂[m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	1.0	.000e+000 1.000e+00		+000) 1.0	000e+000	1	.000e+000			
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.5000e+003	Th	3.5000e+003	5.4252e-004	0.0000
Shear T3, I extreme. Beam # 3. Load case # 1	3.5000e+003	Th	3.5000e+003	-5.4029e-004	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-7.7778e+006	Th	-7.7778e+006	-3.8385e+000	0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	6.2222e+006	Th	6.2222e+006	-1.6685e+000	-0.0000

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

Computational notes:

Authors: Computed errors:





Problem description:

Fixed frame with temperature increase

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:

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Note:



TEST SCHEDULE CASTALIA_STAT083		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT083
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

	GEOMETRY & CONSTRAINTS										
Full Length	[mm]	[mm] Full Height [mm]								C	onstraints
3000			4	-000			-		-		As shown
LOAD											
	Туре				Value	;		Р	oint of applica	ation	
tem	perature			3.0)00e+	-001			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m ²]	E [I	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.0	00e-001	1.200e-0	005			
CROSS-SECTIO	N									Se	zione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm⁴]		W ₂ [mm ³]	W	'₃[mm³]
1.000e+000	1.	000e+0	000	1.000e	+000) 1.0	00e+000	1	.000e+000	1.0)00e+000
W _{pl2} [mm ³]	N	l _{pl3} [mm	³]	i ₂ [m	m]	i;	₃[mm]		i _t [mm]		
1.000e+000	1.	1.000e+000		1.000e	+000) 1.0	00e+000	1	.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-1.1472e-005	Th	-1.1472e-005	6.3623e-012	-0.0001
Shear T3, I extreme. Beam # 3. Load case # 1	1.1472e-005	Th	1.1472e-005	-6.3752e-012	-0.0001
Bending M2, I extreme. Beam # 2. Load case # 1	-1.6686e-002	Th	-1.6686e-002	1.9794e-009	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	2.9201e-002	Th	2.9200e-002	-3.4697e-009	-0.0000

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage
0	

Computational notes:

Authors: Computed errors:





Problem description:

Half portal frame (hinged) with distributed constant load

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT084		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT084
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		GEOMETRY & CONSTRAINTS									7
Full Length	[mm]] Full Height [mm]							Co	onstraints	
3000			4	000			-		-	A	s shown
LOAD											
	Туре			1	Value)		P	oint of application	ation	
force	distribute	d		2.5	570e+	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	[] E	V/mm^2 v		V	α				
2.350e+002	3.600e	+002	2.0	0e+005 3.000e-001		1.200e-	005				
CROSS-SECTIC	N									Se	zione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm ⁴]		W ₂ [mm ³]	Wa	ار[mm ³]
1.000e+000	1.	000e+0	000	1.000e	+000) 1.0)00e+000		1.000e+000	1.0	00e+000
W _{pl2} [mm ³]	W	/ _{pl3} [mm	1 ³]	i₂[m	m]	i,	₃[mm]		i _t [mm]		
1.000e+000	1.	1.000e+000		1.000e	+000	1.0	000e+000		1.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-3.0978e+002	Th	-3.0978e+002	6.3460e-004	-0.0002
Shear T3, J extreme. Beam # 2. Load case # 1	3.4420e+003	Th	3.4420e+003	8.4586e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	1.2391e+006	Th	1.2391e+006	-2.5386e+000	-0.0002

vs

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

Computational notes:

Authors: Computed errors:





Problem description:

Half portal frame (hinged) with shear force

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:

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Note:



TEST SCHEDULE CASTALIA_STAT085		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT085
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

	GEOMETRY & CONSTRAINTS										
Full Length [[mm] Full He			eight [mm]			Dx1 [mm]	Dx1 [mm]		Co	onstraints
3000			4	000			1000		-	A	s shown
LOAD											
-	Гуре			,	Value			Po	int of applic	ation	
NODA	L FORC	E		7.0)00e+	003			Dx1		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005 3.000e-001			1.200e-	005			
CROSS-SECTIO	Ν									Sez	vione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm ⁴]	V	I_{2} [mm ³]	W ₃	[mm ³]
1.000e+000	1.	000e+0	00	1.000e	+000	1.0	000e+000	1.0	000e+000	1.00)0e+000
W _{pl2} [mm ³]	W	_{pl3} [mm	3]	i ₂ [m	m]	i	₃[mm]	i	i _t [mm]		
1.000e+000	1.	1.000e+000		1.000e	+000	1.0	000e+000	1.0	000e+000		
OTHER DATA											

TARGET VALUES

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	-4.1667e+002	Th	-4.1667e+002	7.7955e-004	-0.0002
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	1.6667e+006	Th	1.6667e+006	-3.1184e+000	-0.0002
Bending M2, J extreme. Beam # 2. Load case # 1	-3.5556e+006	Th	-3.5556e+006	-2.0783e+000	0.0001

vs

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

Computational notes:

Authors: Computed errors:





Problem description:

Half portal frame (hinged) with shear force

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT085BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT085BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length	[mm] Full Height [mm]				Dx1 [mm]					Constraints	
3000			4	000			1000		-		As shown
LOAD											
	Туре			Ň	Value				Point of applic	ation	
force of	concentrat	ed		7.0	00e+	003			Dx1		
									-		
									-		
	-										
MATERIAL								Fe360			
f _v [N/mm ²]	f _u [N/m	m²]	E [N	V/mm²]		V	(χ			
2.350e+002	3.600e-	+002 2	2.06	60e+005	3.00	00e-001	1.200	De-005	5		
CROSS-SECTIO	ON									Ś	Sezione1
A [mm ²]		l₂[mm⁴]		J₃ [mr	n ⁴]		t[mm ⁴]		W ₂ [mm ³]	1	W_3 [mm ³]
1.000e+000) 1.0	000e+000	C	1.000e	+000	1.	000e+00)0	1.000e+000	1	.000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i₂[mı	m]		i₃ [mm]		i _t [mm]		
1.000e+000) 1.0	000e+000	C	1.000e+000		1.	000e+00	00	1.000e+000		
OTHER DATA											

TARGET VALUES vs **COMPUTED VALUES**

Description	T_{v}	Т _{vК}	Cv	(C_v-T_v)	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-4.1667e+002	Th	-4.1667e+002	7.9205e-004	-0.0002
Shear T3, J extreme. Beam # 2. Load case # 1	1.7778e+003	Th	1.7778e+003	8.2246e-004	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	1.6667e+006	Th	1.6667e+006	-3.1684e+000	-0.0002

Cv	computed value
Tv	target value
TvK	target value kind (the

eoretical, cross check, accepted).

Th

theoretical value cross check value (theoretical target value is not known, results obtained with a different

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac

100(Tv - Cv) / Cv relative error percentage

Computational notes:

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

Cr





Problem description:

Half portal frame (hinged) with distributed constant load

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT086		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT086
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS									7		
Full Length	[mm]	nm] Full Height [mm]								Co	onstraints
3000			4	000					-	A	s shown
LOAD											
	Туре			1	Value			Р	oint of applica	ation	
force	distribute	d		2.5	570e+	000			-		
									-		
									-		
									-		
MATERIAL]								Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [I	V/mm^2 v		α					
2.350e+002	3.600e	+002	2.0	60e+005	3.00	00e-001	1.200e-	005			
CROSS-SECTIO	N									Se	zione1
A [mm ²]		J ₂ [mm ⁴]]	J₃ [mi	m⁴]	J	t[mm ⁴]		W ₂ [mm ³]	Wa	յ [mm³]
1.000e+000	1.	000e+0	000	1.000e	+000	1.0	00e+000	1	.000e+000	1.0	00e+000
$W_{pl2} [mm^3]$	W	V _{pl3} [mm ³]		i ₂ [m	m]	i,	₃[mm]		i _t [mm]		
1.000e+000	1.	000e+0	e+000 1.000e+00		+000	1.000e+000		1	.000e+000		
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T_{v}	Т _{vК}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 2. Load case # 1	9.7905e+002	Th	9.7905e+002	-8.1583e-004	-0.0001
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-9.3132e-010	-9.3132e-010	-0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	-2.9371e+006	Th	-2.9371e+006	2.4475e+000	-0.0001
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	4.6566e-010	4.6566e-010	0.0000

Cv Tv	computed value 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(Tv - Cv) / Cv	relative error percentage
0	

Computational notes:

Authors: Computed errors:





Problem description:

Half portal frame (hinge) with temperature increase

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT087		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT087
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

	GEOMETRY & CONSTRAINTS										
Full Length [[mm] Full Height [mm]								С	onstraints	
3000			4	-000			-		-	ŀ	\s shown
LOAD											
7	Гуре				Value	;		Р	oint of applic	ation	
temp	perature			3.0	00e+	-001			Only Transve	erse	
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [I	N/mm²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005 3.0		00e-001	1.200e-	005			
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]	,	J₂[mm⁴]		J_3 [mm ⁴]		J	t[mm⁴]		W ₂ [mm ³]	W	₃[mm³]
1.000e+000	1.0	000e+0	00	1.000e	+000) 1.(000e+000	-	1.000e+000	1.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm	3]	i ₂ [m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	1.0	000e+0	00e+000 1.000e+00		+000) 1.(000e+000	-	1.000e+000		
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-5.9593e-006	Th	-5.9593e-006	5.6889e-012	-0.0001
Shear T3, J extreme. Beam # 2. Load case # 1	-7.9457e-006	Th	-7.9457e-006	-2.4148e-012	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	-1.7347e-017	-1.7347e-017	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	2.3837e-002	Th	2.3837e-002	-2.7556e-009	-0.0000

Cv Tv TvK	computed value target value 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).
100/Tex 0: 0 / 0:	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable).
100(1V - CV) / CV	relative error percentage
Computational not	

Computational notes:

Authors: Computed errors:





Problem description:

Half portal frame (clamped-hinge) with distributed constant load

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT088		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT088
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

	GEOMETRY & CONSTRAINTS										
Full Length [mm]	n] Full Height [С	onstraints
3000			4	000			-		-	A	\s shown
LOAD											
-	Гуре			,	Value	;		Р	oint of applic	ation	
force of	distribute	d		2.5	570e+	-000			-		
									-		
									-		
									-		
MATERIAL									Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²]			V	α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.0	00e-001	1.200e-	005			
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	n⁴]	J	t[mm ⁴]		W ₂ [mm ³]	W	₃ [mm³]
1.000e+000	1.0	000e+00	00	1.000e	+000) 1.()00e+000	-	1.000e+000	1.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i₂[m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	1.0	000e+00	00	1.000e+000) 1.0	000e+000	-	1.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T_{v}	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-5.4211e+002	Th	-5.4211e+002	1.2748e-003	-0.0002
Bending M2, I extreme. Beam # 1. Load case # 1	7.2281e+005	Th	7.2281e+005	-1.9030e+000	-0.0003
Bending M2, I extreme. Beam # 2. Load case # 1	-1.4456e+006	Th	-1.4456e+006	3.1962e+000	-0.0002
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

vs

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

Computational notes:

Authors: Computed errors:





Problem description:

Half portal frame (clamped-hinge) frame with shear force

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:

Pictures 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:



TEST SCHEDULE CASTALIA_STAT089		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT089
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

	GEOMETRY & CONSTRAINTS									7	
Full Length	[mm] Full Height [mm					Dx1 [mm]			Co	onstraints	
3000			4	-000			1000		-	A	s shown
LOAD											
	Туре				Value			P	oint of application	ation	
NOD	AL FORC	E		7.0	00e+	003			Dx1		
									-		
									-		
									-		
MATERIAL								Fe360			
f _v [N/mm ²]	f _u [N/m	m²]	E [I	E [N/mm ²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIC	N									Se	zione1
A [mm ²]		J₂[mm⁴]		J₃ [mr	m⁴]	J	t[mm⁴]	1	W ₂ [mm ³]	Wa	₃ [mm ³]
1.000e+000	1.	000e+0	00	1.000e	+000	1.0	00e+000	1	.000e+000	1.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm	3]	i₂[mı	m]	i	₃[mm]		i _t [mm]		
1.000e+000	1.	000e+0	00	1.000e+000		1.0)00e+000	1	.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-7.2917e+002	Th	-7.2917e+002	1.5851e-003	-0.0002
Bending M2, J extreme. Beam # 1. Load case # 1	1.9444e+006	Th	1.9444e+006	-3.9529e+000	-0.0002
Bending M2, I extreme. Beam # 1. Load case # 1	9.7222e+005	Th	9.7222e+005	-2.3868e+000	-0.0002
Bending M2, J extreme. Beam # 3. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000

vs

Cv Tv TvK	computed value target value 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).	
100(Ty – Cy) / Cy	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable).	

Computational notes:

Authors: Computed errors:





Problem description:

Half portal frame (clamped-hinge) with shear force

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:

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.

Note:



TEST SCHEDULE CASTALIA_STAT089BIS		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT089BIS
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

		GEOMETRY & CONSTRAINTS									
Full Length	[mm]	Fu	ull He	eight [mm] D:			Dx1 [mm]			(Constraints
3000			4	.000			1000		-		As shown
LOAD											
	Туре			,	Value			Poi	nt of applic	ation	
force c	oncentrat	ed		7.0	00e+	003			Dx1		
									-		
									-		
									-		
MATERIAL									Fe360		
f _v [N/mm²]	f _u [N/mi	m²]	E [l	N/mm²]	V		α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.00	00e-001	1.200e-	005			
CROSS-SECTIO	ON									S	ezione1
A [mm ²]		l₂[mm⁴]		J₃ [mr	m⁴]	J	t[mm⁴]	N	/ ₂ [mm ³]	V	V_3 [mm ³]
1.000e+000) 1.(000e+0	00	1.000e	+000	1.0	00e+000	1.()00e+000	1.	000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm	3]	i₂[mı	m]	ig	₃[mm]	i	t[mm]		
1.000e+000) 1.(000e+0	00	1.000e+000		1.0	00e+000	1.()00e+000		
OTHER DATA											

TARGET VALUES vs **COMPUTED VALUES**

Description	Τ _ν	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	-7.2917e+002	Th	-7.2917e+002	1.6070e-003	-0.0002
Bending M2, J extreme. Beam # 1. Load case # 1	1.9444e+006	Th	1.9444e+006	-4.0113e+000	-0.0002
Bending M2, I extreme. Beam # 1. Load case # 1	9.7222e+005	Th	9.7222e+005	-2.4160e+000	-0.0002
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-6.9849e-010	-6.9849e-010	-0.0000

Cv	computed value
Tv	target value
TvK	target value kind (theoretica

al, cross check, accepted).

Th Cr

theoretical value cross check value (theoretical target value is not known, results obtained with a different

program are used as target values). accepted value (a value which, on the basis of some argument, can be considered acceptable). Ac 100(Tv - Cv) / Cv relative error percentage

Computational notes:

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





Problem description:

Half portal frame (clamped-hinge) with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT090		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT090
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

	GEOMETRY & CONSTRAINTS												
Full Length	[mm]	Full Height [mm]										Constraints	s
3000			4	000				-		-		As shown	I
LOAD													
	Туре			,	Value)			F	oint of applic	ation		
force	distribute	d		2.5	570e+	000				-			
										-			
										-			
										-			
MATERIAL												Fe36	60
f _v [N/mm ²]	f _u [N/m	m²]	E [ľ	N/mm²]		V		α					
2.350e+002	3.600e-	+002	2.06	60e+005 3.0		3.000e-001		1.200e-0	005				
CROSS-SECTIO	N										S	Sezione1	
A [mm ²]		J₂[mm⁴]		J₃ [mr	n⁴]		J _t	[mm⁴]		W ₂ [mm ³]	\ \	N ₃ [mm ³]	
1.000e+000	1.	000e+00	0	1.000e	+000) 1	.00	00e+000		1.000e+000	1.	.000e+000	1
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i₂[mı	m]		i ₃	[mm]		i _t [mm]			
1.000e+000	1.	000e+00	+000 1.000e+00		+000) 1	.00	00e+000		1.000e+000			
OTHER DATA													

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vK}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	5.7825e+003	Th	5.7825e+003	1.7239e-003	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-4.2833e+006	Th	-4.2833e+006	-3.9855e+000	0.0001
Bending M2, J extreme. Beam # 1. Load case # 1	1.7133e+006	Th	1.7133e+006	-2.9102e+000	-0.0002
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000

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

Computational notes:

Authors: Computed errors:





Problem description:

Half portal frame (clamped, support) with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT091		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT091
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

	GEOMETRY & CONSTRAINTS											
Full Length [mm]	Full Height [mm]										Constraints
3000			4	000			-			-		As shown
LOAD												
-	Гуре			,	Value	;			Po	oint of applic	ation	
force of	distribute	d		2.5	570e+	-000				-		
										-		
										-		
										-		
MATERIAL												Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	[N/mm ²]		V		α				
2.350e+002	3.600e-	+002	2.0	060e+005 3.0		3.000e-001		200e-0	05			
CROSS-SECTIO	Ν										S	Sezione1
A [mm ²]		l₂[mm⁴]		J₃ [mr	m⁴]		J _t [mm	l ⁴]	1	N ₂ [mm ³]	\	N ₃ [mm ³]
1.000e+000	1.0	000e+00	0	1.000e	+000) 1.	000e+	-000	1	.000e+000	1	.000e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]		i₂[mı	m]		i₃ [mm	l]		i _t [mm]		
1.000e+000	1.0	000e+00	0e+000 1.000e+00		+000) 1.	000e+	-000	1	.000e+000		
OTHER DATA												

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vК}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	2.7517e-007	2.7517e-007	0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-5.7825e+005	Th	-5.7825e+005	1.0787e+000	-0.0002
Bending M2, I extreme. Beam # 2. Load case # 1	-5.7825e+005	Th	-5.7825e+005	1.0798e+000	-0.0002
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-4.6566e-010	-4.6566e-010	-0.0000

Cv Tv	computed value target value	
IvK	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(Tv - Cv) / Cv	relative error perc	centage
O		

Computational notes:

Authors: Computed errors:





Problem description:

Half portal frame (clamped, support) with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT092		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT092
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

	GEOMETRY & CONSTRAINTS										
Full Length [I	mm]	Full Height [mm]								С	onstraints
3000			4	-000			-		-	ŀ	As shown
LOAD											
T	_уре				Value)		P	pint of application	ation	
force of	distribute	d		2.5	570e+	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	[N/mm ²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005 3.0		00e-001	1.200e-	005			
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]		l₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm ⁴]	1	N ₂ [mm ³]	W	₃ [mm ³]
1.000e+000	1.0	000e+00	00	1.000e	+000) 1.0	000e+000	1	.000e+000	1.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i ₂ [m	m]		₃[mm]		i _t [mm]		
1.000e+000	1.0	000e+00	00e+000 1.000e+00		+000) 1.0	000e+000	1	.000e+000		
OTHER DATA											

TARGET VALUES vs

COMPUTED VALUES

Description	Τ _ν	T_{vK}	Cv	$(C_{\nu}-T_{\nu})$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	1.0280e+004	Th	1.0280e+004	2.2829e-006	0.0000
Shear T3, J extreme. Beam # 2. Load case # 1	1.8276e+003	Th	1.8276e+003	-1.6168e-004	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.5077e+007	Th	-1.5077e+007	-4.9616e-001	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-5.4827e+006	Th	-5.4827e+006	4.8403e-001	-0.0000

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage
Computational not	

Computational notes:

Authors: Computed errors:





Problem description:

Half portal frame (clamped, support) with horizontal force

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:

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Note:


TEST SCHEDULE CASTALIA_STAT093		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT093
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS]	
Full Length [mm] Full Height [mm]								Co	nstraints	
3000			4	-000			-		-	A	s shown
LOAD											
-	Гуре				Value			Р	oint of applica	ation	
NODA	L FORC	E		7.0)00e+C	03			-		
									-		
									-		
									-		
MATERIAL									Fe360		
f _v [N/mm ²]	f _u [N/m	m²]	E [l	[N/mm ²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005 3.0		0e-001	1.200e-0)05			
CROSS-SECTIO	Ν									Sez	vione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm⁴]		W ₂ [mm ³]	W ₃	[mm ³]
1.000e+000	1.0	000e+0	00	1.000e	+000	1.0	00e+000	1	.000e+000	1.00)0e+000
W _{pl2} [mm ³]	W	_{pl3} [mm	³]	i ₂ [m	m]	ig	₃ [mm]		i _t [mm]		
1.000e+000	1.	1.000e+000		1.000e	+000	1.0	00e+000	1	.000e+000		
OTHER DATA	OTHER DATA										

TARGET VALUES vs

COMPUTED VALUES

Description	T _v	Т _{vK}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	7.0000e+003	Th	7.0000e+003	3.5532e-006	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-1.1200e+007	Th	-1.1200e+007	9.8987e-001	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	-1.6800e+007	Th	-1.6800e+007	-1.0041e+000	0.0000
Bending M2, J extreme. Beam # 2. Load case # 1	0.0000e+000	Th	-9.3132e-010	-9.3132e-010	-0.0000

Cv Tv TvK	computed value target value target value kind ((theoretical, cross check, accepted).
	Th Cr	theoretical value 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(Tv – Cv) / Cv	relative error perc	entage
Computational note		

Computational notes:

Authors: Computed errors:





Problem description:

Closed rectangular Frame with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT094		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT094
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [mm]	n] Full Height [mm]								Co	onstraints
3000			4	-000			-		-	A	s shown
LOAD											
-	Гуре				Value)		Р	oint of applica	ation	
force	distribute	d		2.5	570e+	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [N/mm ²]			V	α				
2.350e+002	3.600e	+002	2.0)60e+005 3.0		00e-001	1.200e-0	005			
CROSS-SECTIO	N									Sea	zione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm⁴]		W ₂ [mm ³]	W ₃	[mm ³]
1.000e+000	1.	000e+0	00	1.000e	+000) 1.0	00e+000	1	.000e+000	1.00)0e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³	3]	i ₂ [m	m]	i,	₃[mm]		i _t [mm]		
1.000e+000	1.	1.000e+000		1.000e	+000	1.0)00e+000	1	.000e+000		
OTHER DATA	OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 2. Load case # 1	3.8550e+003	Th	3.8550e+003	-9.0949e-013	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	2.5418e+005	Th	2.5418e+005	-1.1550e-001	-0.0000
Bending M2, I extreme. Beam # 3. Load case # 1	-2.5418e+005	Th	-2.5418e+005	1.1550e-001	-0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	-1.0802e+006	Th	-1.0802e+006	1.1573e-001	-0.0000

vs

Cv Tv TvK	computed value target value target value kind	(theoretical, cross check, accepted).
	Th Cr	theoretical value 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(1V - CV) / CV	relative error perc	centage
• • • • • •		

Computational notes:

Authors: Computed errors:





Problem description:

Two-spans frame with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT095		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT095
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS										7	
Full Length	[mm]	mm] Full Height [mm]								С	onstraints
6000=3000+	-3000		4	000			-		-	A	s shown
LOAD											
	Туре			,	Value			Po	int of applica	ation	
force	distribute	d		2.5	570e+0	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [I	N/mm ²]		V	α				
2.350e+002	3.600e	+002	2.0	060e+005 3.0		0e-001	1.200e-0	005			
CROSS-SECTIO	DN									Se	zione1
A [mm ²]		J₂[mm ⁴]		J₃ [mr	n⁴]	J	t[mm⁴]	V	V ₂ [mm ³]	W	₃[mm³]
1.000e+000	1.	000e+0	00	1.000e	+000	1.0	00e+000	1.	000e+000	1.0	00e+000
W _{pl2} [mm ³]	W	/ _{pl3} [mm ³	3]	i ₂ [mi	m]	ia	₃[mm]		i _t [mm]		
1.000e+000	1.	1.000e+000		1.000e	+000	1.0	00e+000	1.	000e+000		
OTHER DATA	OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-3.0978e+002	Th	-3.0978e+002	-2.2420e-003	0.0007
Bending M2, I extreme. Beam # 5. Load case # 1	0.0000e+000	Th	-2.3548e-010	-2.3548e-010	-0.0000
Bending M2, I extreme. Beam # 1. Load case # 1	4.1304e+005	Th	4.1304e+005	2.8731e+000	0.0007
Bending M2, J extreme. Beam # 1. Load case # 1	8.2607e+005	Th	8.2608e+005	6.0947e+000	0.0007

vs

Cv Tv	computed value target value	theoretical cross check accorted)
IVK	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100(Tv - Cv) / Cv	Ac relative error perc	accepted value (a value which, on the basis of some argument, can be considered acceptable). entage
o		

Computational notes:

Authors: Computed errors:





Problem description:

Three-spans frame with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT096		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT096
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [I	mm]	Full Height [mm]								Co	onstraints
9000=3x30	00		4	000			-		-	A	s shown
LOAD											
T	уре			1	Value	;		Р	oint of applica	ation	
force of	distribute	d		2.5	570e+	-000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/mi	m²]	E [N/mm ²]		V	α					
2.350e+002	3.600e-	+002	2.0	60e+005 3.000e-001		1.200e-	005				
CROSS-SECTIO	Ν									Sez	zione1
A [mm ²]		l₂[mm⁴]		J₃ [mi	n⁴]	J	t[mm ⁴]		W ₂ [mm ³]	W ₃	[mm ³]
1.000e+000	1.(000e+00	00	1.000e	+000) 1.()00e+000	1	.000e+000	1.00)0e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i₂[m	m]	i	₃ [mm]		i _t [mm]		
1.000e+000	1.0	.000e+000 1.000e+0		+000) 1.000e+000 1.0		.000e+000				
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vK}	C _v	$(C_v - T_v)$	$100 \frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 7. Load case # 1	3.3078e+002	Th	3.3078e+002	1.5225e-003	0.0005
Bending M2, J extreme. Beam # 4. Load case # 1	8.8208e+005	Th	8.8208e+005	4.2322e+000	0.0005
Bending M2, I extreme. Beam # 1. Load case # 1	4.4104e+005	Th	4.4104e+005	1.8577e+000	0.0004
Bending M2, J extreme. Beam # 1. Load case # 1	8.8208e+005	Th	8.8208e+005	4.2322e+000	0.0005

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage
Computational not	

Computational notes:

Authors: Computed errors:





Problem description:

Hinged portal frame, double supported cantilever, distributed constant load.

- 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:

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Note:



TEST SCHEDULE CASTALIA_STAT097		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT097
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [I	mm]	n] Full Height [mm]								С	onstraints
9000=3x30	00		4	000			-		-	ŀ	As shown
LOAD											
T	уре			1	Value)		Р	oint of applic	ation	
force of	distribute	b		2.5	570e+	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/mi	n²]	E [l	[N/mm ²]		V	α				
2.350e+002	3.600e-	-002	2.0	60e+005 3.000		00e-001	1.200e-	005			
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]		l₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm ⁴]		W ₂ [mm ³]	W	₃ [mm³]
1.000e+000	1.(000e+00	00	1.000e	+000) 1.0)00e+000	1	1.000e+000	1.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i₂[m	m]	i,	₃[mm]		i _t [mm]		
1.000e+000	1.0	1.000e+000 1.0		1.000e	+000	1.0)00e+000	1	1.000e+000		
OTHER DATA	OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 4. Load case # 1	-4.4618e+001	Th	-4.4619e+001	-1.1158e-003	0.0025
Bending M2, I extreme. Beam # 1. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	3.1292e+006	Th	3.1292e+006	-7.4334e+000	-0.0002
Bending M2, I extreme. Beam # 2. Load case # 1	-3.3077e+006	Th	-3.3077e+006	2.9701e+000	-0.0001

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage

Computational notes:

Authors: Computed errors:







Problem description:

Two-floors frame with distributed constant load

- **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:

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Note:



TEST SCHEDULE CASTALIA_STAT098		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT098
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

GEOMETRY & CONSTRAINTS											
Full Length [mm]	m] Full Height [mm]								C	constraints
3000		80)00=4	000+4000)		-		-		As shown
LOAD											
-	Гуре			1	Value			P	oint of application	ation	
force	distribute	d		2.5	570e+	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005	+005 3.000e-001		1.200e-0	005			
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]		J ₂ [mm ⁴]]	J₃ [mi	m⁴]	J	t[mm⁴]		W ₂ [mm ³]	W	′₃[mm³]
1.000e+000	1.	000e+0	000	1.000e	+000	1.0	00e+000	1	.000e+000	1.0)00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm	າ ³]	i₂[m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	1.0	1.000e+000 1.0		1.000e	+000	1.0)00e+000	1	.000e+000		
OTHER DATA	OTHER DATA										

TARGET VALUES

COMPUTED VALUES

Description	T _v	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-1.5944e+002	Th	-1.5944e+002	-1.2372e-005	0.0000
Bending M2, I extreme. Beam # 2. Load case # 1	7.2281e+005	Th	7.2281e+005	-7.7355e-002	-0.0000
Bending M2, I extreme. Beam # 5. Load case # 1	0.0000e+000	Th	0.0000e+000	0.0000e+000	0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	6.3778e+005	Th	6.3778e+005	4.9388e-002	0.0000

vs

Cv Tv TvK	computed value target value target value kind	(theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100/The Child Child	Ac	accepted value (a value which, on the basis of some argument, can be considered acceptable).
100(10 - C0) / C0	relative error perc	entage
Computational not		

Computational notes:

Authors: Computed errors:





Problem description:

Two-floors frame with distributed constant load

- **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:

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Note:



TEST SCHEDULE CASTALIA_STAT099		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT099
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8	k COI	NSTRAI	NTS				
Full Length [mm]	F	ull He	eight [mm]						С	onstraints
3000		80	00=4	000+4000)		-		-	ŀ	\s shown
LOAD											
-	Гуре			1	Value	•		Po	oint of applic	ation	
force of	distribute	d		2.5	570e+	000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm ²]		V	α				
2.350e+002	3.600e-	+002	2.0	60e+005	3.0	00e-001	1.200e-0	005			
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	m⁴]	J	t[mm⁴]	'	W ₂ [mm ³]	W	₃ [mm³]
1.000e+000	1.0	000e+C	000	1.000e	+000	1.0)00e+000	1	.000e+000	1.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm	³]	i₂[m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	1.0	000e+0	000	1.000e	+000	1.0)00e+000	1	.000e+000		
OTHER DATA											

TARGET VALUES

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	4.7833e+001	Th	4.7833e+001	-4.4954e-005	-0.0001
Bending M2, I extreme. Beam # 2. Load case # 1	3.6141e+005	Th	3.6141e+005	-2.3599e-001	-0.0001
Bending M2, I extreme. Beam # 5. Load case # 1	0.0000e+000	Th	-1.4552e-011	-1.4552e-011	-0.0000
Bending M2, J extreme. Beam # 1. Load case # 1	-1.9133e+005	Th	-1.9133e+005	1.7981e-001	-0.0001

vs

Cv Tv TvK	computed value target value 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).
100(Tv – Cv) / Cv	Ac accepted value (a value which, on the basis of some argument, can be considered acceptable). relative error percentage
0	

Computational notes:

Authors: Computed errors:





Problem description:

3 hinges portal with distributed constant load

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:

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Note:



TEST SCHEDULE CASTALIA_STAT100		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT100
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8		NSTRAII	NTS				
Full Length [Length [mm] Full Height [mm]								С	onstraints	
3000			4	000			-		-	A	\s shown
LOAD											
-	Гуре			,	Value	;		Р	oint of applic	ation	
force of	distribute	d		2.5	570e+	-000			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [l	N/mm ²] v		α					
2.350e+002	3.600e-	+002	2.0	60e+005	3.0	00e-001	1.200e-	005			
CROSS-SECTIO	Ν									Se	zione1
A [mm ²]		J₂[mm⁴]		J₃ [mi	J ₃ [mm ⁴] վ		t[mm ⁴]		W ₂ [mm ³]	W	₃ [mm³]
1.000e+000	1.0	000e+00	00	1.000e	+000) 1.()00e+000	-	1.000e+000	1.0	00e+000
W _{pl2} [mm ³]	W	_{pl3} [mm ³]	i₂[m	m]	i	₃[mm]		i _t [mm]		
1.000e+000	1.0	000e+00	00	1.000e	+000) 1.0	000e+000	-	1.000e+000		
OTHER DATA											

TARGET VALUES vs **COMPUTED VALUES**

Description	T _v	T_{vK}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	-7.2281e+002	Th	-7.2281e+002	4.5475e-013	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	3.8550e+003	Th	3.8550e+003	-3.6380e-012	-0.0000
Bending M2, I extreme. Beam # 3. Load case # 1	0.0000e+000	Th	-2.3283e-010	-2.3283e-010	-0.0000
Bending M2, J extreme. Beam # 4. Load case # 1	2.8913e+006	Th	2.8912e+006	-9.3132e-010	-0.0000

Cv Tv TvK	computed value target value target value kind (theoretical, cross check, accepted).
	Th Cr	theoretical value cross check value (theoretical target value is not known, results obtained with a different program are used as target values).
100(Ty – Cy) / Cy	Ac relative error perce	accepted value (a value which, on the basis of some argument, can be considered acceptable).
Computational note		

Computational notes:

Authors: Computed errors:





Problem description:

3 hinges portal with horizontal force

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:

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Note:



TEST SCHEDULE CASTALIA_STAT101		
SOLVING	BEAM PROBLEM	SOL.SAR.STAT101
FINITE ELEMENT	SOLVER	CLEVER (SARGON ©)

			GEC	METRY 8		NSTRAI	NTS				
Full Length [th [mm] Full Height [mm]									C	Constraints
3000			4	-000			-		-		As shown
LOAD											
-	Гуре				Value	•		P	oint of applica	ation	
NODA	L FORC	E		7.0	00e+	003			-		
									-		
									-		
									-		
MATERIAL											Fe360
f _v [N/mm ²]	f _u [N/m	m²]	E [I	N/mm²]		V	α				
2.350e+002	3.600e	+002	2.0	60e+005	3.00	00e-001	1.200e-0	005			
CROSS-SECTIO	Ν									S	ezione1
A [mm ²]		J₂[mm⁴]		J₃ [mr	m⁴]	J	t[mm⁴]		W ₂ [mm ³]	W	/ ₃ [mm ³]
1.000e+000	1.	000e+0	00	1.000e	+000	1.0	00e+000	1	.000e+000	1.()00e+000
W _{pl2} [mm ³]	W	՝ _{pl3} [mm ³	3]	i₂[mı	m]	i	₃[mm]		i _t [mm]		
1.000e+000	1.	000e+0	00	1.000e	+000	1.0)00e+000	1	.000e+000		
OTHER DATA											

TARGET	VALUES
--------	--------

COMPUTED VALUES

Description	T _v	Т _{vК}	Cv	$(C_v - T_v)$	$100\frac{T_v - C_v}{C_v}$
Shear T3, I extreme. Beam # 1. Load case # 1	3.5000e+003	Th	3.5000e+003	-5.2418e-006	-0.0000
Shear T3, I extreme. Beam # 2. Load case # 1	-9.3333e+003	Th	-9.3333e+003	1.3645e-005	-0.0000
Bending M2, I extreme. Beam # 3. Load case # 1	0.0000e+000	Th	4.6566e-010	4.6566e-010	0.0000
Bending M2, J extreme. Beam # 4. Load case # 1	1.4000e+007	Th	1.4000e+007	-2.0967e-002	-0.0000

vs

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

Computational notes:

Authors: Computed errors:

