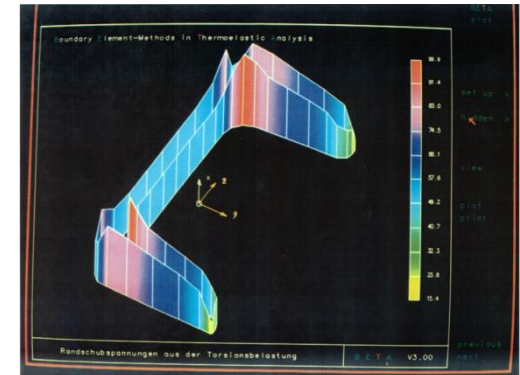
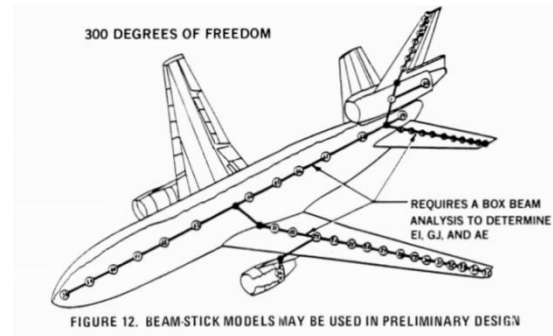
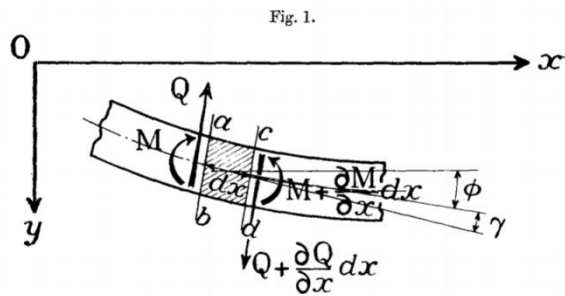
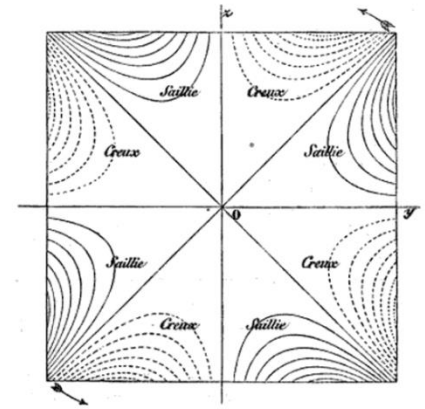
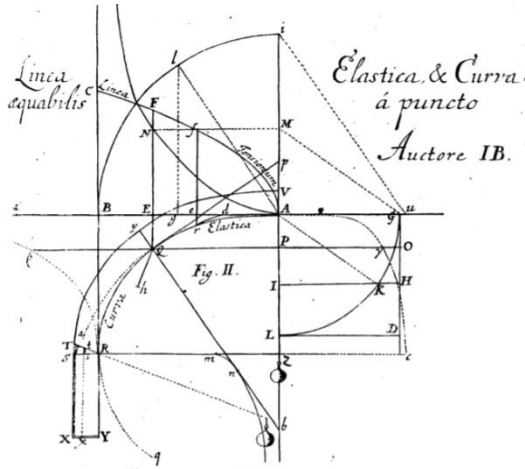
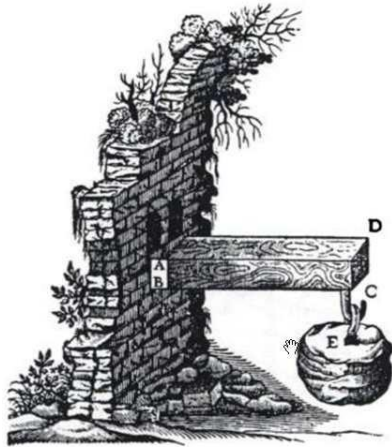


Beam Modeling New Developments

Kostas Skolarikis, Vasileios Evangelou

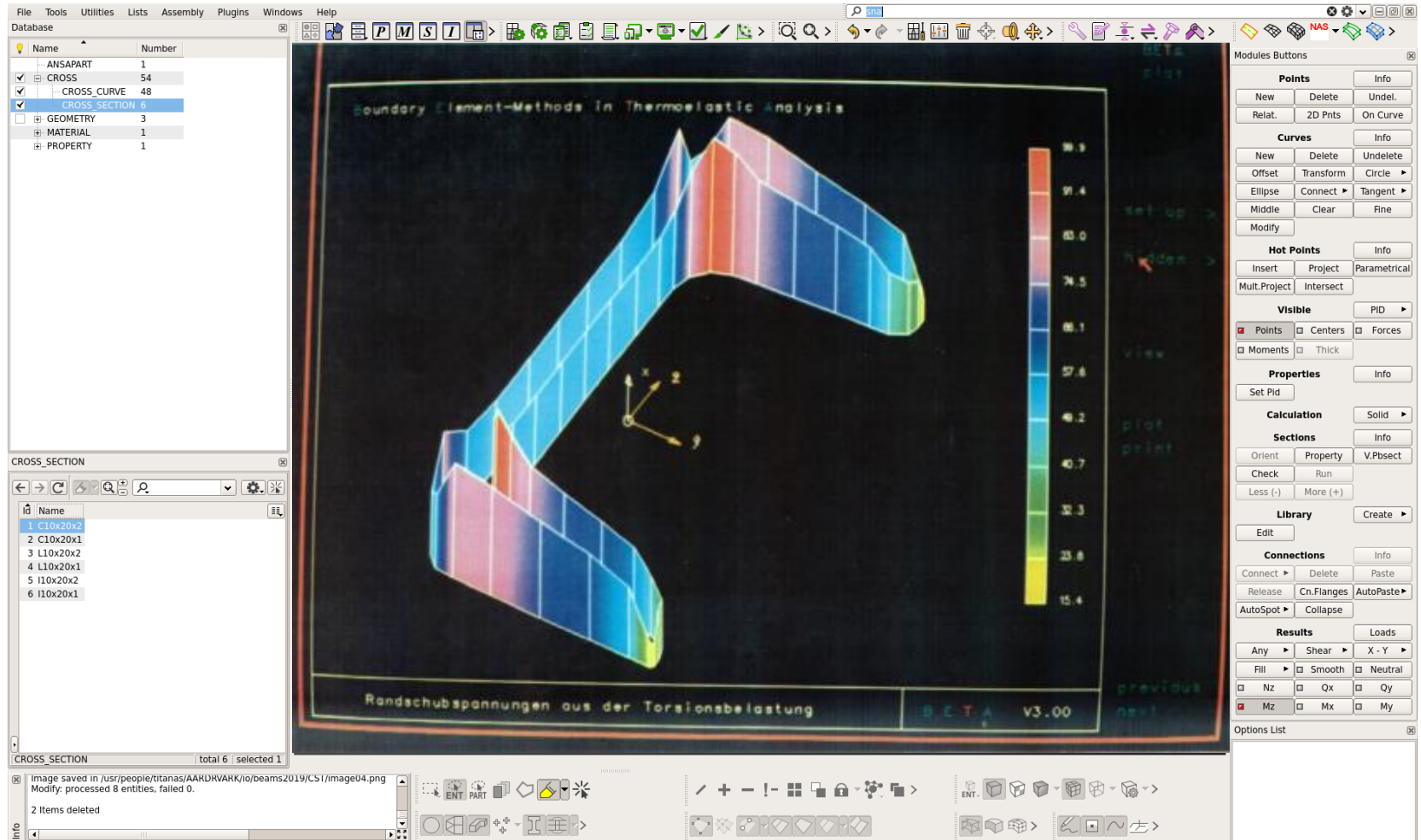
May 2019

Beam Calculations in History



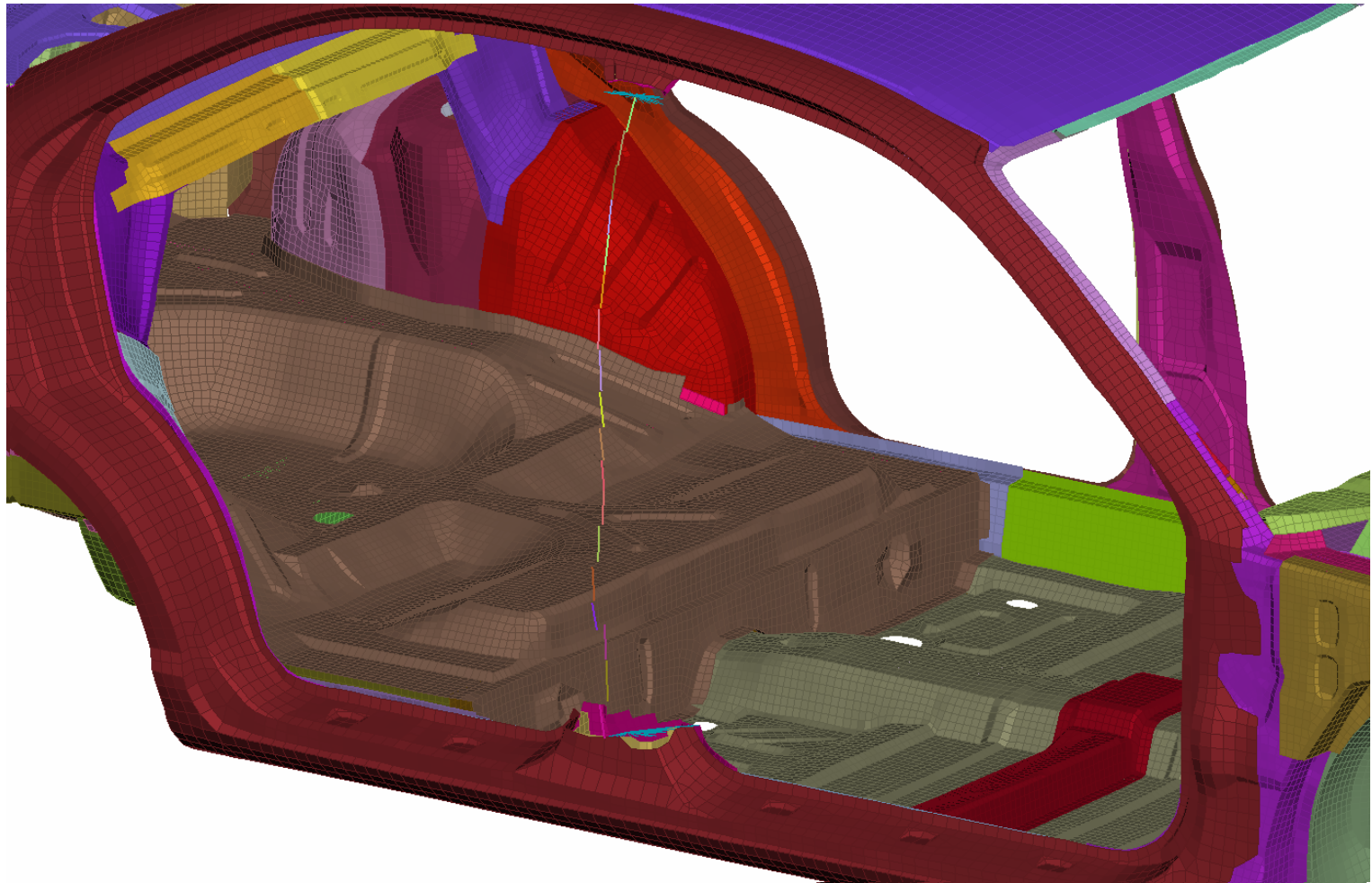
Cross Section Tool

Integration of BETA in ANSA



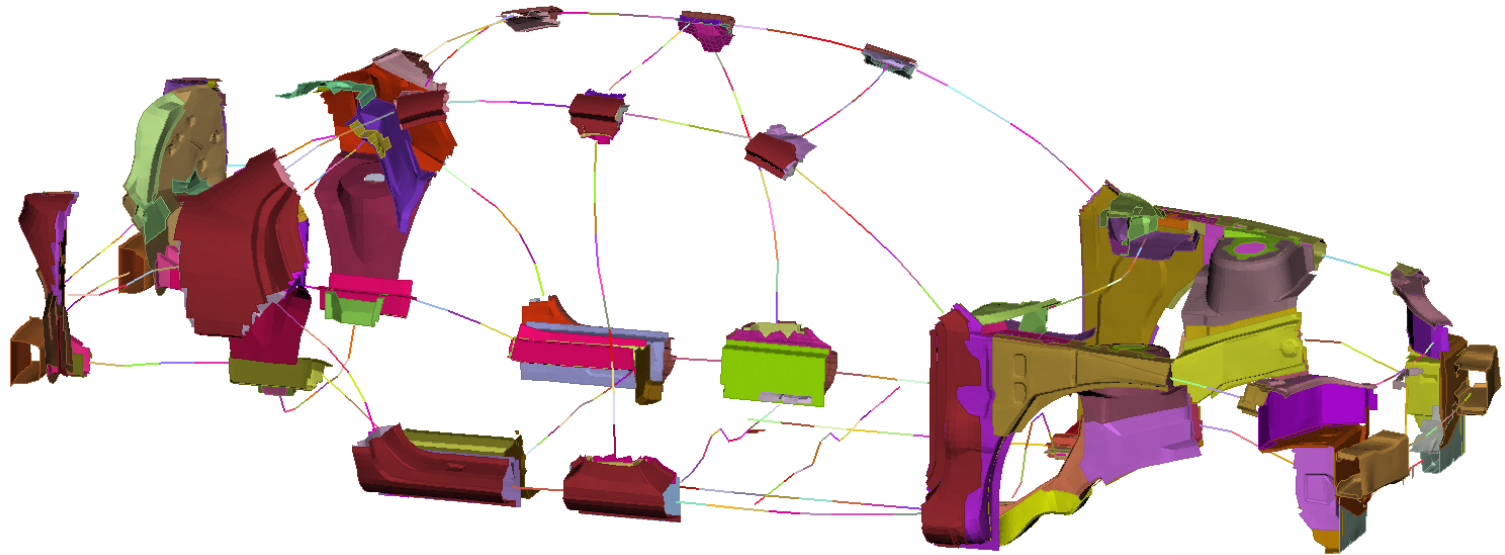
Cross Section Tool

Multicut

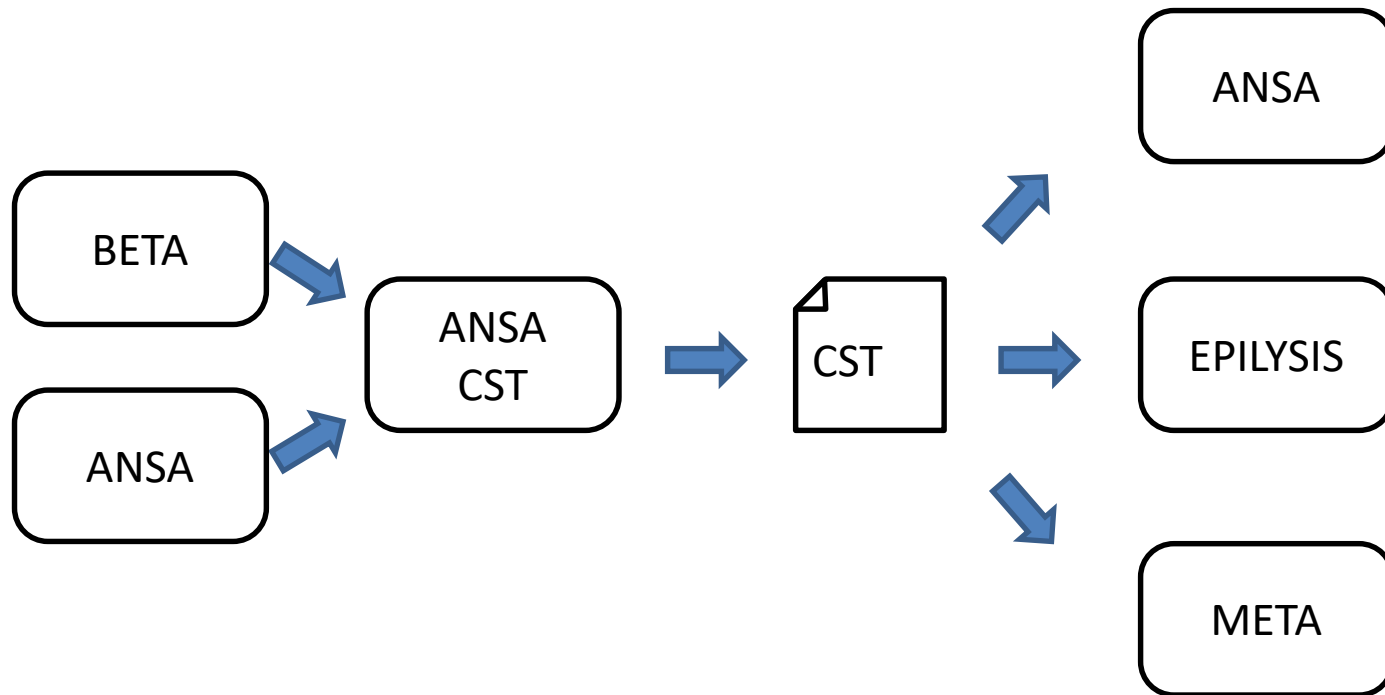


Cross Section Tool

Beam optimization plugin

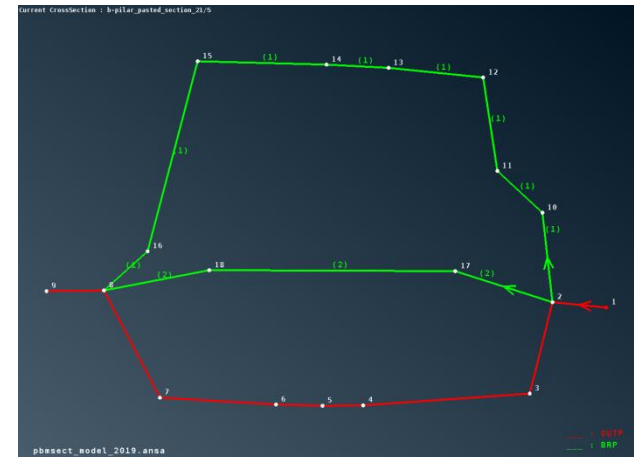
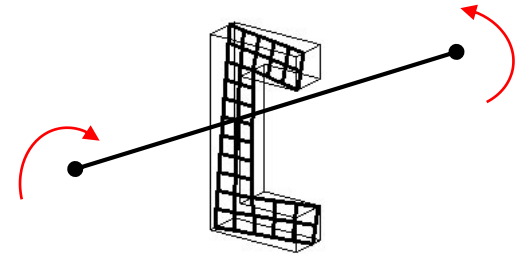
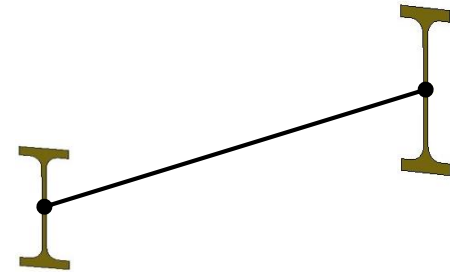


Cross Section Tool as a library tool



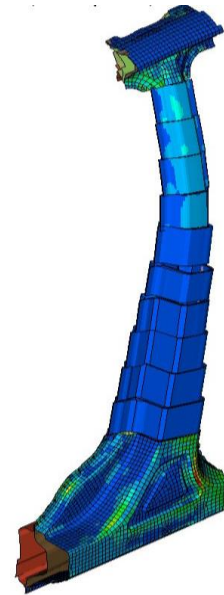
Beams in Epilysis – New developments

- Tapered Beams
- Torsional Warping
- PBEAML , PBRSECT Optimization

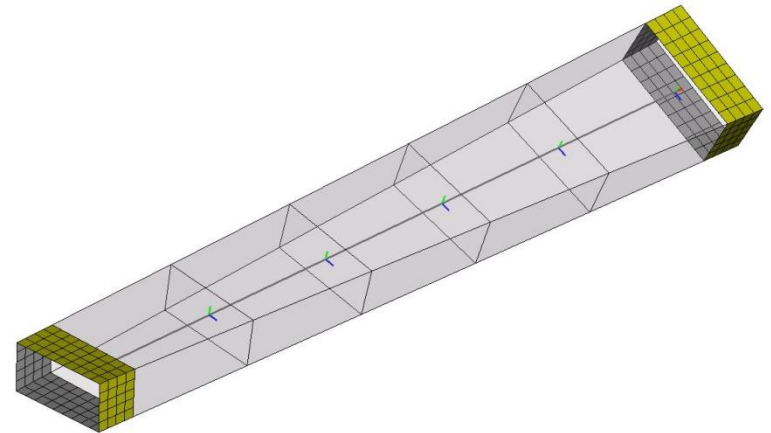


Beams in Meta – New developments

- **Stress Recovery**

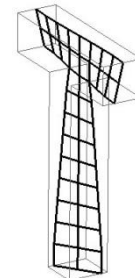
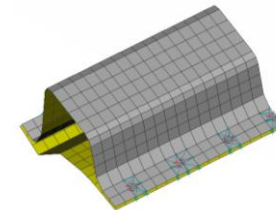
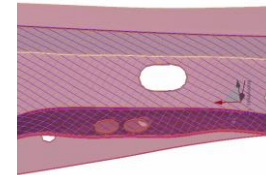


- **Rotation Animation**



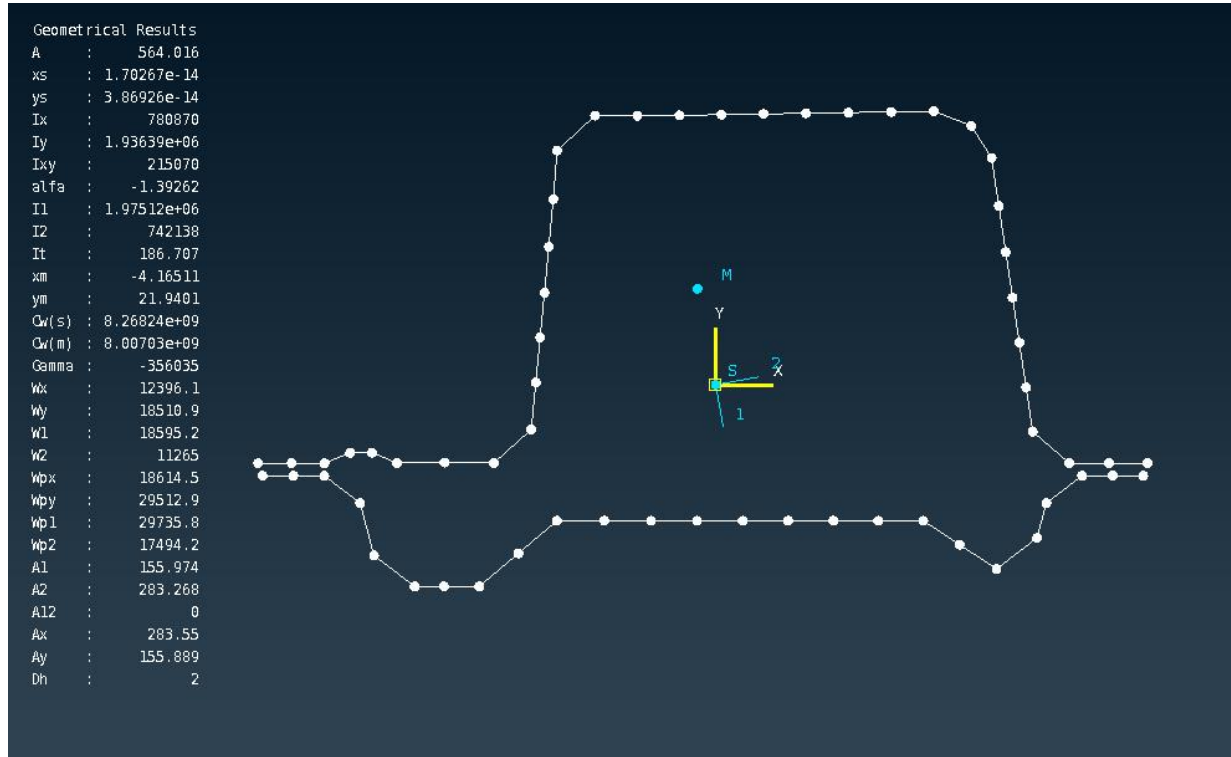
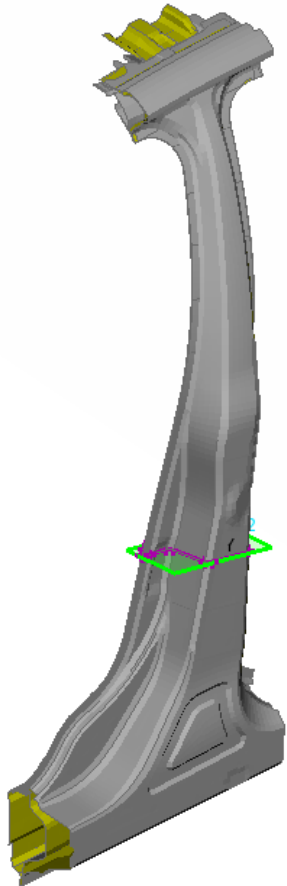
Major Shortcomings of current Algorithms

- **Multimaterial sections**
- **Composite beams**
- **Spot welded beams**
- **Missing results**



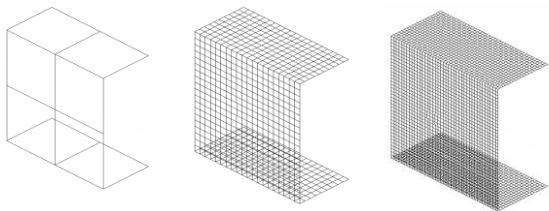
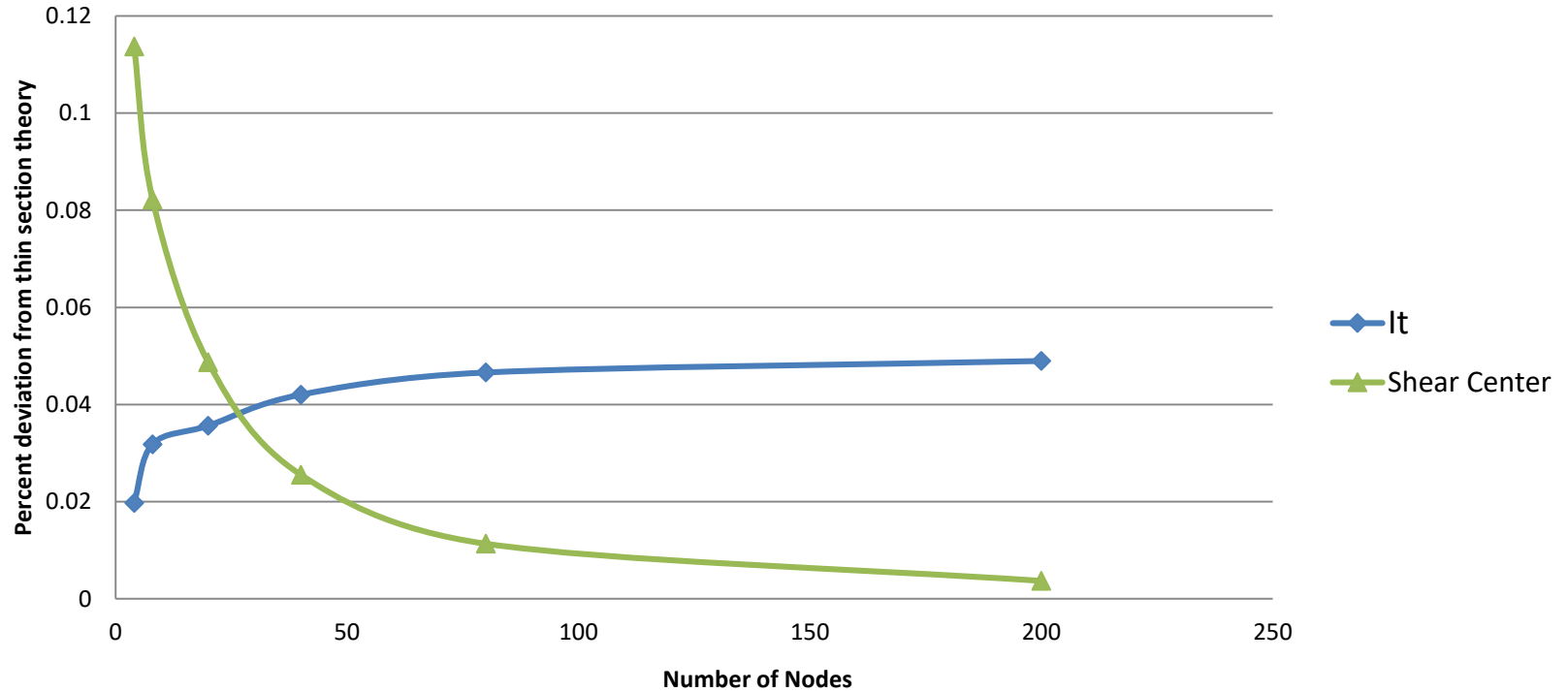
New FE algorithm

Takes into account the cut's underlying mesh



New FE algorithm

Influence of mesh size on calculated cross section properties



Beam's warping dof

CBEAM [CBEAM]

Name

FROZEN_ID FROZEN_DELETE FROZEN

EID	PID	GA	GB	Orient	X1	X2	X3	OFFT
5437	136	5695	5696	With Vector	.99988684	0	.01504368	
PA	PB	W1A	W2A	W3A	W1B	W2B	W3B	
		.03245172	-2.84E-14	-.0742554	0	0	0	
SA	SB							

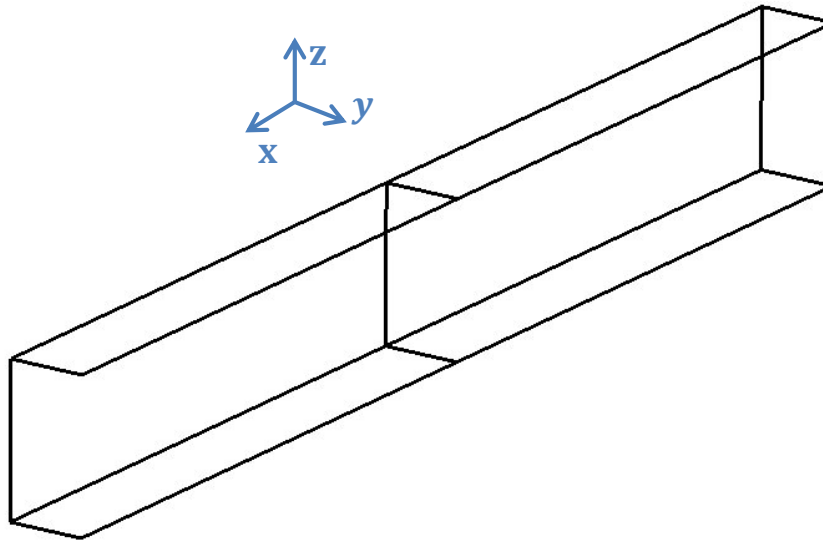
length
Comm

*<F1> : select from drawing area
<F2> : edit the referenced entity
<F3> : list user defined variables
<?> : select from list*

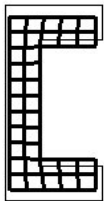
Scalar or grid point identification number for the end A.
The degrees-of-freedom at this points are the warping variables d / dx . SA cannot be specified for beam p-elements. (Integers > 0 or blank)

OK

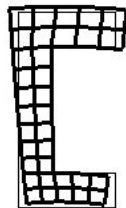
Cross section warping modes



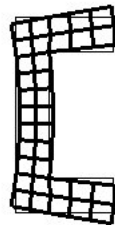
N



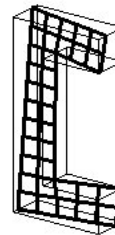
M_y



M_z



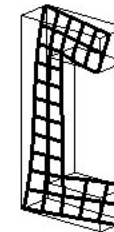
M_x



Q_y



Q_z



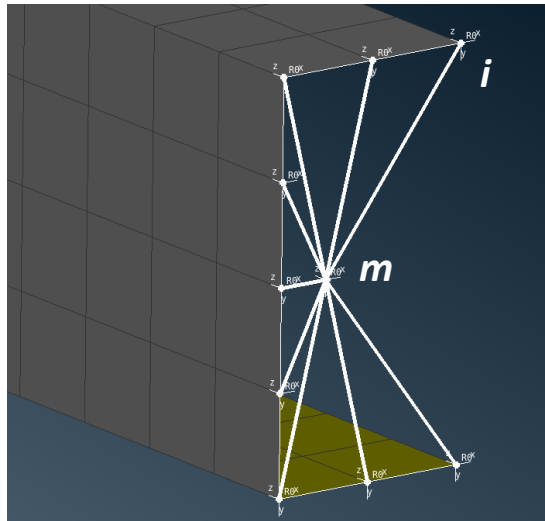
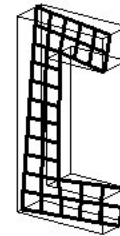
In-plane warping modes

Out-of-plane warping modes

RSECTBT - A new R-type element

A new EPILYSIS element for beam to shell/solid connection

RSECTBT = RBE2
(Rigid Body Modes)



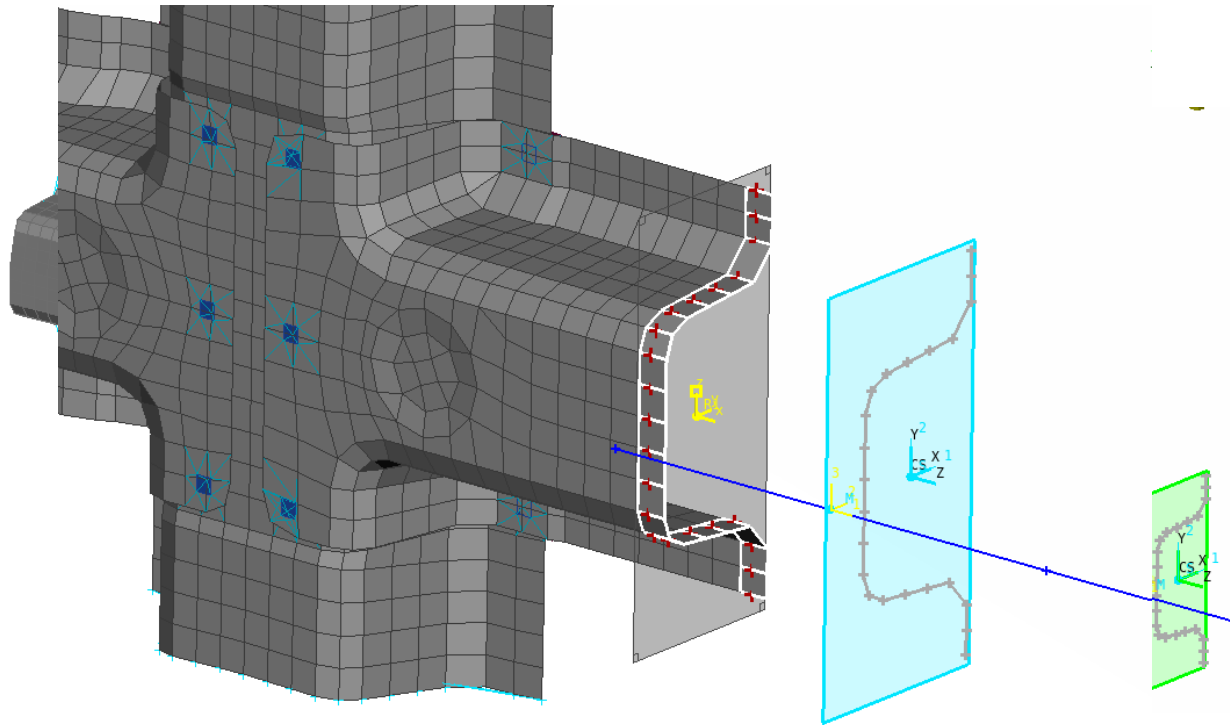
$$u_x^i = \underbrace{u_x^m + a_1 \theta_y^m + a_2 \theta_z^m}_{\text{Rigid body motion}} + \underbrace{a_3 s_w^m}_{\text{Torsional warping}}$$

Rigid body motion

Torsional warping

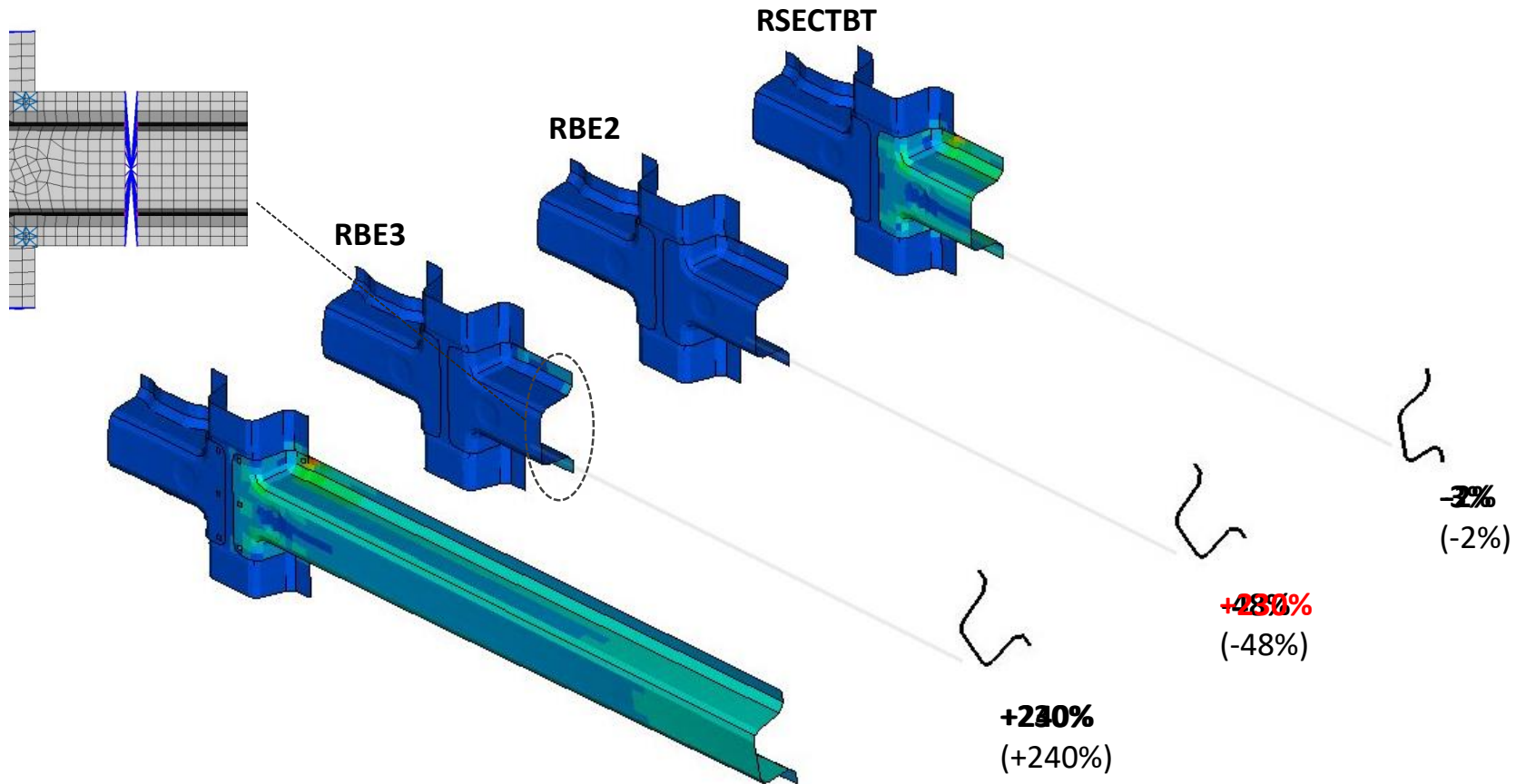
RSECTBT

Connecting nodes are always placed on cross section's plane

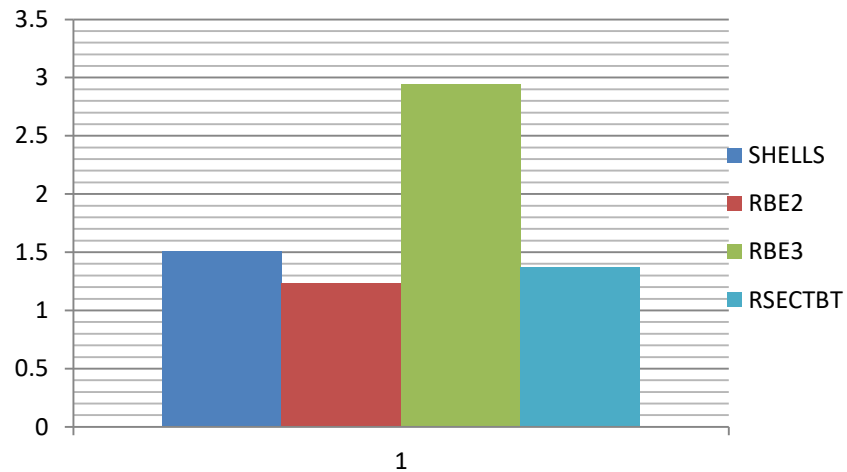


RSECTBT - Verification

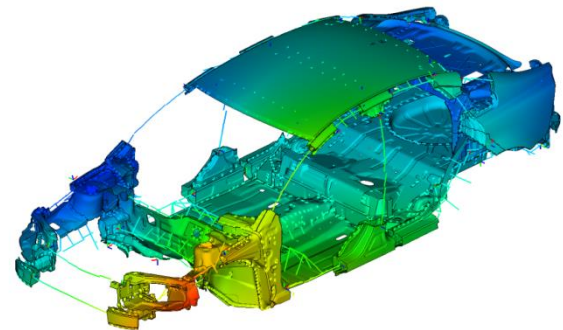
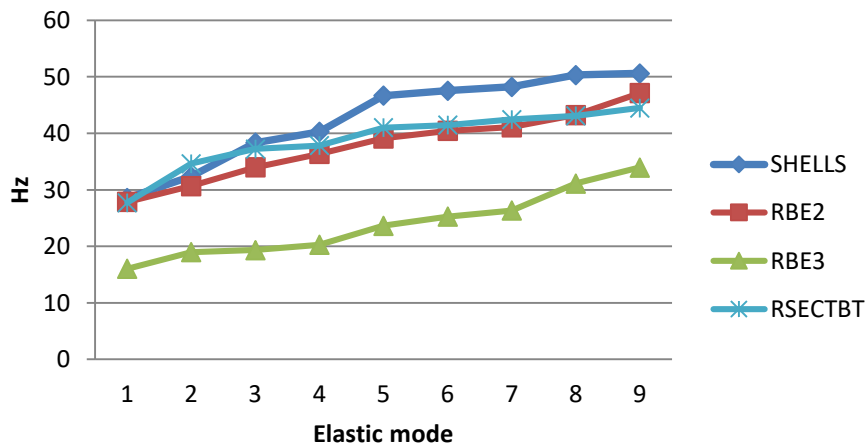
Testing RSECTBT against other R-type elements



RSECTBT - Verification

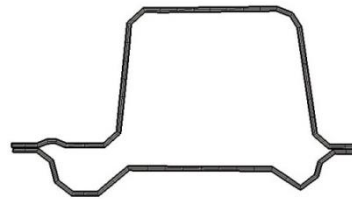
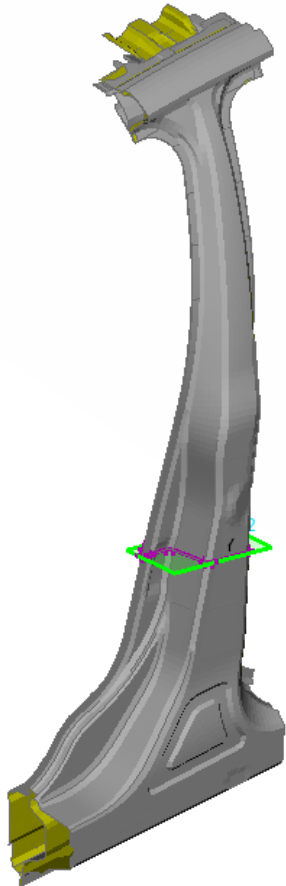


Normal modes

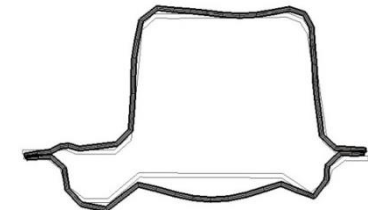
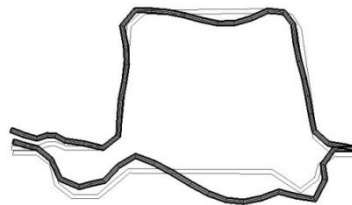
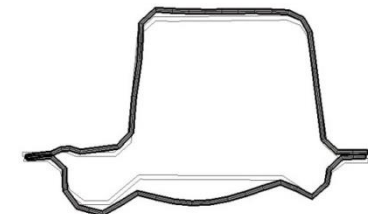
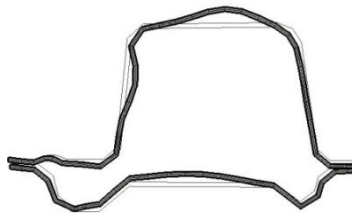


Beyond 7th dof

Cross section warping modes of non-uniform beams



Torsional warping mode

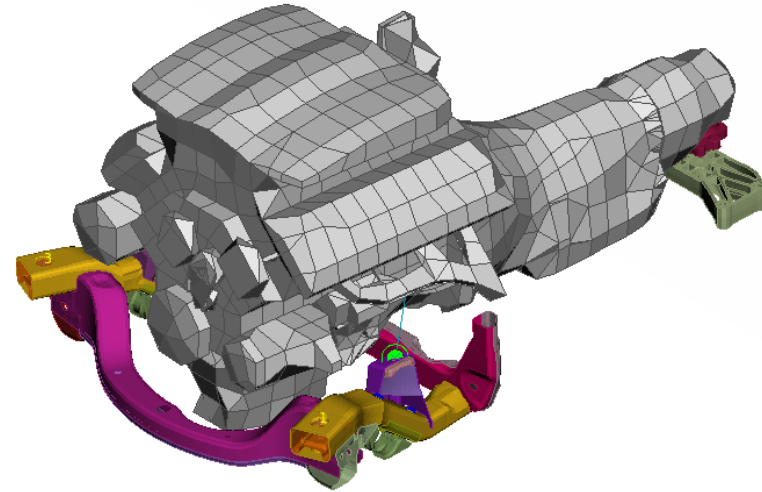


Dynamic warping modes

Superelements

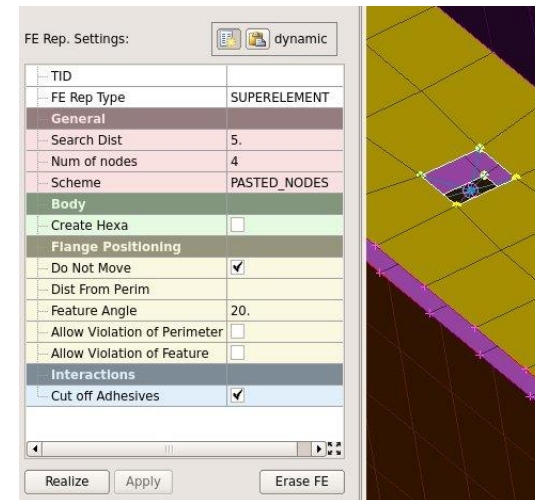
Integrated solutions in ANSA and META

- Dynamic Reduction of Subsystems
- Spot Welds representation

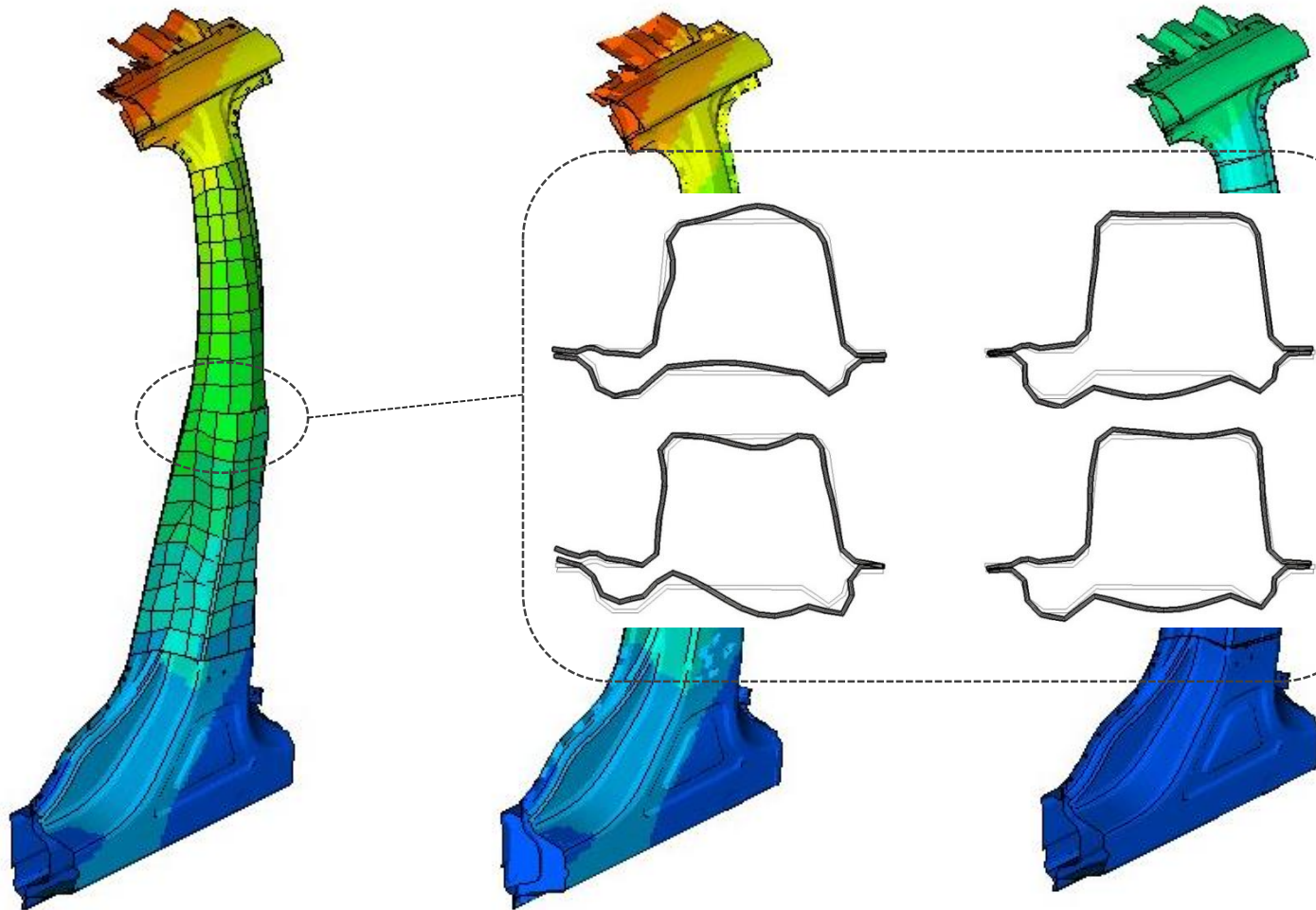


Latest developments

- Full support in Epilysis
- Script support



Superelements in beam modeling



SE model

FE model

Beam model

What is the future of beams in CAE ?

Thank you

