

FEM Utilities for CATIA

General

FEM Utilities for CATIA features:

- Core enhanced meshing and modelling functionalities
- Optional FEA bidirectional gateways to
 - o NASTRAN Bulk
 - o ANSYS Prep7
 - o IDEAS

Core enhanced meshing and modelling Functionalities

Manual meshing

Meshing operations on nodes:

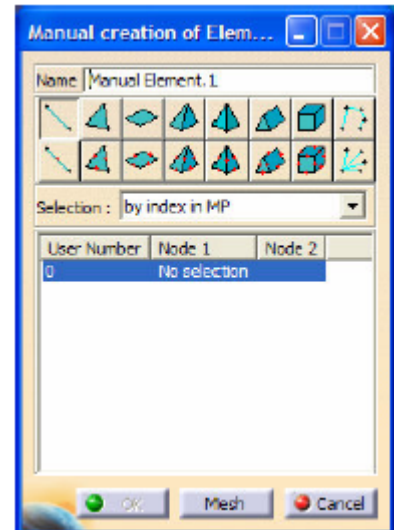
- creation by coordinates, with two existing nodes and a ratio,...
- deletion of nodes
- modification of position
- condensation on destination nodes

Meshing operations on elements:

- creation of 1D, 2D and 3D elements
- deletion of elements
- modification of elements

Full support of spec – update paradigm:

- “Manual Mesh Part” feature used to group manual operations
- advanced nodes and elements selection capabilities enable stability of selection during the updates



Semi-automatic meshing

Three families of capabilities:

- mesh part operators used to modify the result of a mesh part
- meshing by transformation of an existing mesh (including symmetry)
- meshing by extrusion of an existing mesh

Very flexible input specifications:

- input mesh selection by mesh part, group, BRep or mechanical feature
- input mesh can be nodes, 1D elements (or edges), 2D elements (or faces) and 3D elements
- implicit geometry characteristics can be used (e.g. the axis of a cylindrical face)

Supported transformations are translation, rotation, offset, along a spine and projection

Pre-processing

Numbering of FEA data

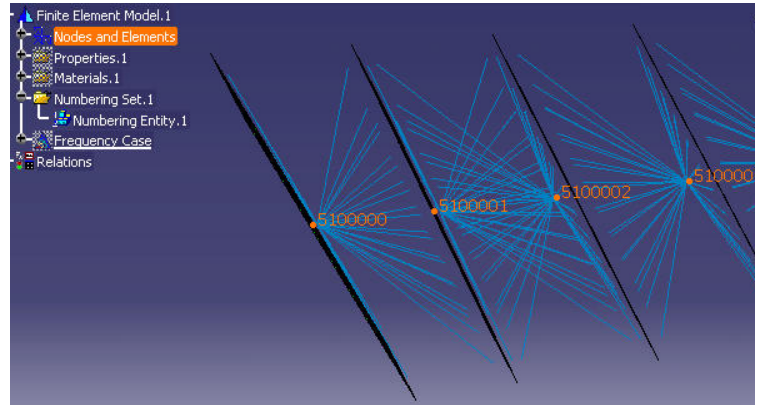
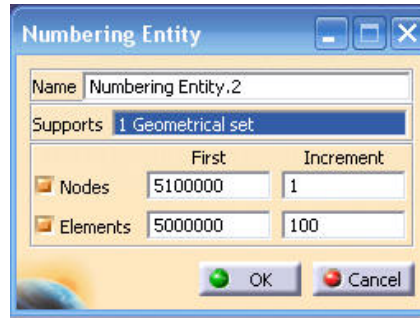
Through this capability the user is able to control the numbering used by the FEA interfaces when exporting data.

Logical operations on groups

Through this capability the user is able to perform logical operations on groups of nodes or elements. The inputs can be any feature capable of selecting nodes or elements, mesh parts, BReps and mechanical features.

Others

Support of journaling
Access to all capabilities via VB Scripting
Full integration with KnowledgeWare



FEA bidirectional gateways

NASTRAN gateways

Supported formats are:

- NASTRAN Bulk and op2

Capabilities:

- import and export of structural FE data and results
- support of GPS local beam and shell properties
- support of composite properties
- support of assembly of analysis documents
- support of FEA user numbering if present in the model
- support of multiple load cases and solvers
- support of data mapping

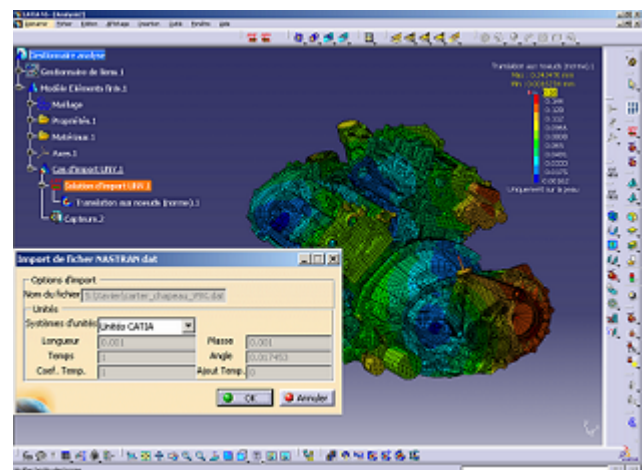
ANSYS gateways

Supported formats are:

- ANSYS prep7

Capabilities:

- import and export of linear structural FE data
- support of GPS local beam and shell properties
- support of assembly of analysis documents
- support of FEA user numbering if present in the model
- support of multiple load cases and solvers
- support of data mapping



IDEAS gateways

Provides CATIA V5 analysis users with a by-directional IDEAS Universal File Format

- import and export of linear structural FE data
- import of results for post-processing within CATIA V5 (static, frequency and fatigue solutions)
- export of ELFINI results
- support of GPS local beam and shell properties
- support of assembly of analysis documents
- support of FEA user numbering if present in the model
- support of multiple load cases
- support of data mapping

Packaging

FEM Utilities for CATIA is packaged with a set of Core functionalities and includes one gateway.

Additional gateways can be added independently as Add on gateways.

FEM Utilities gateways come in two configurations Basic or Advanced.

The detailed list of functionalities available in the Core product and in both configurations of the different gateways is documented below.

FEM Utilities core functionalities are the following:

Function	Feature	Available in version 3.0	New in version 3.1
Manual Element Creation	Volume Connectivities	ü	
	All Other Connectivities	ü	
	Spider Connectivity with selection by groups	ü	
	Other connectivities with selection by groups		ü
	Assign Physical Type	ü	
Manual Element Modification	All Connectivities	ü	
	Selection by groups	ü	
	Modify Physical Type		ü
Manual Element Deletion	Selection by entities	ü	
	Selection by groups	ü	
	Selection by Trap	ü	
Manual Node Creation	By coordinates	ü	
	Between nodes	ü	
	On a vertex	ü	
	On a line		ü
	On a surface		ü
Manual Node Modification	Selection by entities	ü	
Manual Node Deletion	Selection by entities	ü	
	Selection by groups	ü	
	Free nodes only	ü	
	Selection by Trap	ü	
Manual Condensation	Selection by entities	ü	
	Selection by groups	ü	
Mesh Operators	Moving volume elements	ü	
	Moving elements of all other connectivities	ü	
Mesh by extrusion	Basic capability to produce volume elements	ü	
	Basic capability to produce surfacic elements	ü	
	Re-use of reference mesh associativity	ü	
	Duplication or not of reference mesh nodes	ü	
	Associativity with geometry used during projection	ü	
Constraint Property	Selection by MeshParts/groups + parameters (rigid or smooth)	ü	
Numbering	Nodes, elements, material, property ...	ü	
	Assembly of Analysis	ü	
	Ordered Numbering Set	ü	
	Topological Numbering (1D and 2D Elements)	ü	
Groups	Logical operations on groups	ü	
	Manual Selection Group	ü	
	Trap Selection Group	ü	
Basic Manual Meshing (without history, journaling, scripting, user-friendly)	Creation of nodes (coordinates, on vertices)	ü	
	Creation of elements	ü	
	Condensation node to node		ü
	Modify node on vertices		ü
	Delete Nodes		ü
	Delete Elements		ü

NASTRAN Basic and Advanced gateways are the following:

Module	Function	Feature	Configuration		Available in	
			Basic	Advanced	3.0	3.1
Import	Nodes	GRID	ü		ü	
	Elements	CBAR	ü			
		CBEAM	ü		ü	
		CBUSH	ü		ü	
		CELAS1	ü		ü	
		CHEXA	ü		ü	
		CPENTA	ü		ü	
		CQUAD4	ü		ü	
		CQUAD8	ü		ü	
		CTETRA	ü		ü	
		CTRIA3	ü		ü	
		CTRIA6	ü		ü	
		RBE2	ü		ü	
		RBE3	ü		ü	
		CWELD	ü		ü	
		CGAP	ü		ü	
		CROD	ü		ü	
		CSHEAR	ü		ü	
		MAT1	ü		ü	
		MAT2		ü	ü	
		Materials	MAT8		ü	ü
	Properties	PBAR	ü		ü	
		PBEAM	ü		ü	
		PBUSH	ü		ü	
		PELAS	ü		ü	
		PSHELL	ü		ü	
		PSOLID	ü		ü	
		PWELD	ü		ü	
		PGAP	ü		ü	
		PROD	ü		ü	
		PSHEAR	ü		ü	
		PCOMP		ü	ü	
	Axis System	CORD1R	ü		ü	
		CORD2R	ü		ü	
		CORD1C	ü		ü	
		CORD2C	ü		ü	
		CORD1S	ü		ü	
		CORD2S	ü		ü	
	Groups	SET1		ü	ü	
		SET		ü	ü	
	Restraints	SPC		ü		ü
	Loads	SPCD		ü		ü
		FORCE		ü		ü
		MOMENT		ü		ü
		PLOAD4		ü		ü
		GRAV		ü		ü
		TEMP		ü		ü
	Masses	CONM2		ü		ü
	Results (OP2)	Static case		ü	ü	
		Frequency case		ü	ü	
		Buckling case		ü	ü	
	Group By Physical Type	On Property Entity		ü	ü	
		On Material Entity		ü	ü	
		On Property Set		ü	ü	
		On Material Set		ü	ü	
		On Nodes and Elements Set		ü	ü	
Local Properties	Property 2D		ü	ü		
	Property 3D		ü	ü		
	Property 1D		ü	ü		
Groups By Dimensions	Under Group Set		ü	ü		
	Under Mesh Parts		ü	ü		

Module	Function	Feature	Configuration		Available in	
			Basic	Advanced	3.0	3.1
Export	Nodes & Elements	All Mesh Parts DS or imported & Assembly of Analysis	ü		ü	
	Materials	Material / User Material, Isotropic	ü		ü	
		Material / User Material, Composite		ü	ü	
	Properties	Property Shell (Global & Local)	ü		ü	
		Property Beam (Global & Local)	ü		ü	
		Property Membrane	ü		ü	
		Property Shear	ü		ü	
		Property Composite		ü	ü	
	Connection Properties	Slider Connection Property	ü		ü	
		Contact Connection Property	ü		ü	
		Fastened Connection Property	ü		ü	
		Fastened Spring Connection Property	ü		ü	
		Pressure Fitting Connection Property	ü		ü	
		Rigid Connection Property	ü		ü	
		Smooth Connection Property	ü		ü	
		Spot Welding Connection Property	ü		ü	
		Seam Welding Connection Property	ü		ü	
		Surface Welding Connection Property	ü		ü	
		Nodes to Nodes Connection Property	ü		ü	
		Node Interface Property	ü		ü	
		User-Defined Connection Property	ü		ü	
	Virtual Parts	Smooth Virtual Part	ü		ü	
		Contact Virtual Part	ü		ü	
		Rigid Virtual Part	ü		ü	
		Rigid Spring Virtual Part	ü		ü	
		SmoothSpringVirtual Part	ü		ü	
	Groups	SET1	ü		ü	
		SET	ü		ü	
	Restraints	Clamp	ü		ü	
		Surface Slider	ü		ü	
		Slider	ü		ü	
		Sliding Pivot	ü		ü	
		Ball Join	ü		ü	
		Pivot	ü		ü	
		Sliding Pivot	ü		ü	
		User-defined Restraint	ü		ü	
		Isostatic Restraint	ü		ü	
	Loads	Pressure	ü		ü	
		Distributed Force & Imported Force	ü		ü	
		Bearing Load	ü		ü	
		Moment & Imported Moment	ü		ü	
		Acceleration	ü		ü	
		Rotation Force	ü		ü	
		Line Force Density	ü		ü	
		Surface Force Density	ü		ü	
		Volume Force Density	ü		ü	
		Force Density	ü		ü	
		Enforced Displacement	ü		ü	
		Temperature Field	ü		ü	
		Combined Loads	ü		ü	
		Assembled Loads	ü		ü	
	Masses	Distributed Mass	ü		ü	
		Line Mass Density	ü		ü	
		Surface Mass Density	ü		ü	
		Distributed Mass and Inertia	ü		ü	
		Combined Mass	ü		ü	
		Assembled Mass	ü		ü	
	Case	Static case	ü		ü	
		Frequency case	ü		ü	
		Buckling case	ü		ü	
	Results (OP2)	Static case		ü	ü	
		Frequency case		ü	ü	
		Buckling case		ü	ü	
	Launch computation			ü	ü	

ANSYS Basic and Advanced gateways are the following:

Module	Function	Feature	Configuration		Available in	
			Basic	Advanced	3.0	3.1
Import	Nodes	N	ü		ü	
		NSEL	ü		ü	
	Elements	E, EN, EMORE	ü		ü	
		ET	ü		ü	
	Materials	MP, MAT	ü		ü	
		<i>(anisotropic, orthotropic)</i>		ü	ü	
	Properties	BEAM4	ü		ü	
		COMBIN14	ü		ü	
		CONTAC52	ü		ü	
		SOLID45	ü		ü	
		SOLID92	ü		ü	
		SOLID95	ü		ü	
		SHELL63	ü		ü	
		SHELL93	ü		ü	
		SHELL41	ü		ü	
		SHELL28	ü		ü	
		SHELL181		ü	ü	
		SHELL281		ü	ü	
		CERIG	ü		ü	
		RBE3	ü		ü	
	PIPE16	ü		ü		
	Axis System	CSYS	ü		ü	
		CSKP	ü		ü	
		NROTAT	ü		ü	
	Group By Physical Type	On Property Entity			ü	ü
		On Material Entity			ü	ü
		On Property Set			ü	ü
		On Material Set			ü	ü
		On Nodes and Elements Set			ü	ü
	Local Properties	Property 2D			ü	ü
		Property 3D			ü	ü
		Property 1D			ü	ü
	Groups By Dimensions	Under Group Set			ü	ü
Under Mesh Parts				ü	ü	

Module	Function	Feature	Configuration		Available in	
			Basic	Advanced	3.0	3.1
Export	Nodes & Elements	All Mesh Parts DS or imported & Assembly of Analysis	ü		ü	
	Materials	Material / User Material, Isotropic	ü		ü	
		Material / User Material, Composite		ü	ü	
	Properties	Property Shell (Global & Local)	ü		ü	
		Property Beam (Global & Local)	ü		ü	
		Property Membrane (Global & Local)	ü		ü	
		Property Shear (Global & Local)	ü		ü	
		Property Solid	ü		ü	
		Property Composite			ü	ü
	Connection Properties	Slider Connection Property	ü		ü	
		Contact Connection Property	ü		ü	
		Rigid Connection Property	ü		ü	
		Smooth Connection Property	ü		ü	
		Nodes to Nodes Connection Property (rigid only)	ü		ü	
		User-Defined Connection Property (except bolt tightening)	ü		ü	
	Virtual Parts	Smooth Virtual Part	ü		ü	
		Contact Virtual Part	ü		ü	
		Rigid Virtual Part	ü		ü	
		Rigid Spring Virtual Part	ü		ü	
		SmoothSpringVirtual Part	ü		ü	
	Groups	All Groups		ü	ü	
	Restraints	Clamp	ü		ü	
		Surface Slider	ü		ü	
		Slider	ü		ü	
		Sliding Pivot	ü		ü	
		Ball Join	ü		ü	
		Pivot	ü		ü	
		Sliding Pivot	ü		ü	
		User-defined Restraint	ü		ü	
		Isostatic Restraint	ü		ü	
	Loads	Pressure	ü		ü	
		Distributed Force & Imported Force	ü		ü	
		Bearing Load	ü		ü	
		Moment & Imported Moment	ü		ü	
		Acceleration	ü		ü	
		Rotation Force	ü		ü	
		Line Force Density	ü		ü	
		Surface Force Density	ü		ü	
		Volume Force Density	ü		ü	
		Force Density	ü		ü	
		Enforced Displacement	ü		ü	
		Temperature Field	ü		ü	
		Combined Loads	ü		ü	
		Assembled Loads	ü		ü	
	Masses	Distributed Mass	ü		ü	
		Line Mass Density	ü		ü	
		Surface Mass Density	ü		ü	
		Distributed Mass and Inertia	ü		ü	
		Combined Mass	ü		ü	
		Assembled Mass	ü		ü	
	Case	Static case	ü		ü	
		Frequency case	ü		ü	
		Buckling case	ü		ü	

IDEAS Basic and Advanced gateways are the following:

Module	Function	Feature	Configuration		Available in	
			Basic	Advanced	3.0	3.1
Import	Units	164	ü		ü	
	Nodes	781	ü		ü	
		2411	ü		ü	
	Elements	780	ü		ü	
		2412	ü		ü	
	Materials	1710	ü		ü	
		1714	ü		ü	
		1716	ü		ü	
			<i>Anisotropic, Orthotropic</i>		ü	ü
	Properties	789	ü		ü	
		2448	ü		ü	
		2470	ü		ü	
		776	ü		ü	
		2415		ü	ü	
	Axis System	2420		ü	ü	
	Case	793		ü	ü	
		2428		ü	ü	
	Results	55		ü	ü	
		56		ü	ü	
		57		ü	ü	
		2414		ü	ü	
	Group By Physical Type		<i>On Property Entity</i>		ü	ü
			<i>On Material Entity</i>		ü	ü
			<i>On Property Set</i>		ü	ü
			<i>On Material Set</i>		ü	ü
			<i>On Nodes and Elements Set</i>		ü	ü
	Local Properties		<i>Property 2D</i>		ü	ü
			<i>Property 3D</i>		ü	ü
			<i>Property 1D</i>		ü	ü
	Groups By Dimensions		<i>Under Group Set</i>		ü	ü
		<i>Under Mesh Parts</i>		ü	ü	

Module	Function	Feature	Configuration		Available in	
			Basic	Advanced	3.0	3.1
Export	Nodes & Elements	All Mesh Parts DS or imported & Assembly of Analysis	ü		ü	
	Materials	Material / User Material, Isotropic	ü		ü	
		Material / User Material, Composite		ü	ü	
	Properties	Property Shell (Global & Local)	ü		ü	
		Property Beam (Global & Local)	ü		ü	
		Property Membrane	ü		ü	
		Property Shear	ü		ü	
		Property Composite		ü	ü	
	Connection Properties	Slider Connection Property	ü		ü	
		Contact Connection Property	ü		ü	
		Fastened Connection Property	ü		ü	
		Fastened Spring Connection Property	ü		ü	
		Rigid Connection Property	ü		ü	
		Smooth Connection Property	ü		ü	
		Nodes to Nodes Connection Property	ü		ü	
		User-Defined Connection Property (except bolt tightening)	ü		ü	
	Virtual Parts	Smooth Virtual Part	ü		ü	
		Contact Virtual Part	ü		ü	
		Rigid Virtual Part	ü		ü	
		Rigid Spring Virtual Part	ü		ü	
		SmoothSpringVirtual Part	ü		ü	
	Groups	All GPS Groups		ü	ü	
	Restraints	Clamp	ü		ü	
		Surface Slider	ü		ü	
		Slider	ü		ü	
		Sliding Pivot	ü		ü	
		Ball Join	ü		ü	
		Pivot	ü		ü	
		Sliding Pivot	ü		ü	
		User-defined Restraint	ü		ü	
		Isostatic Restraint	ü		ü	
		Loads	Pressure	ü		ü
	Distributed Force & Imported Force		ü		ü	
	Bearing Load		ü		ü	
	Moment & Imported Moment		ü		ü	
	Acceleration		ü		ü	
	Rotation Force		ü		ü	
	Line Force Density		ü		ü	
	Surface Force Density		ü		ü	
	Volume Force Density		ü		ü	
	Force Density		ü		ü	
	Enforced Displacement		ü		ü	
	Temperature Field		ü		ü	
	Combined Loads		ü		ü	
	Assembled Loads		ü		ü	
	Masses	Distributed Mass	ü		ü	
		Line Mass Density	ü		ü	
		Surface Mass Density	ü		ü	
		Combined Mass	ü		ü	
		Assembled Mass	ü		ü	
	Case	Static case	ü		ü	
		Frequency case	ü		ü	
	Results	Static case		ü	ü	
Frequency case			ü	ü		