CAESS

Center for Advanced Engineering Software and Simulations

CAESS ProTOp data sheet

Valid from: September, 2019

Environment	
Computer	High-end personal computer with Intel® 64 or compatible processor
Platform and OS	x64; Windows® 7/8.0/8.1/10, 64 bit
Prerequisites	Microsoft® .NET Framework 4.5
Internet connectivity	not required
Min hardware recommendation	Intel® i7 4-core CPU or similar; 32 GB RAM
Integration	PTC® Creo®

Input FEM model formats	
FNF by PTC® Creo®	YES[1]; single part only (models with more than one part are not supported)
INP by Simulia® Abaqus and SolidWorks® Simulation	YES[1]; single part and single instance only (models with more than one part or instance are not supported)
GEO by SolidWorks® Simulation	YES[1]; single part and single instance only (models with more than one part or instance are not supported)
DAT by Siemens NX™	YES[1]; single part and single instance only (models with more than one part or instance are not supported)
[1] **Not all features are supported**; for more information see the ProTOp documentation	

Optimization FEA model	
Elements	Special small-displacements and for topology optimization enriched elements: ▪ Tetrahedral TTH4 and TTH10 (4 and 10 nodes) ▪ Hexahedral HXH8 (8 nodes)
Materials	▪ Isotropic linear elastic ▪ Orthotropic linear elastic ▪ Special semi-contact ▪ Special semi-plastic
Loading	Static and quasi-static (dynamics simulation) loading by

	- Forces - Displacements - Thermal Simultaneous Forces/Displacements/Thermal loading within one load case is enabled inherently by underlying technologies.

Topology optimization

Objective	- Minimum strain energy - Maximal lowest eigenfrequency
Targeting	- Volume part - Boundary stress (on cut surfaces; static analysis only) - Max displacement (static analysis only)

Shape optimization, (TTH4 only)

Objective	- Maximal geometrical smoothness of the surface - Minimal stress levels and variations on the surface
Active surfaces	- Stripped surfaces obtained after topology optimization - High-stress surfaces of free domains

Design constraints

Uni-directional opening with optional draft angle	YES
Bi-Uni-directional opening with optional draft angle	YES
Bi-directional opening	YES
Bi-directional opening excluding fixed regions	YES
Plane symmetry	YES
Axisymmetry	YES
Periodic angular	YES
Periodic linear	YES

Model configuring

Lattice	YES, full 3D solid FEs

Shell	YES, full 3D solid FEs
Mixed lattice/shell	YES, full 3D solid FEs
Crossings and interfaces rounding	YES
Simultaneous optimization of all configured regions	YES

Special features

Efficient semi-contact modelling	YES, pin joints, pin loading, bolts/rivets fastening, …
Efficient semi-plastic modelling	YES
Easy elastic/semi-plastic switching	YES
Compression/tension sensitivity control	YES

Results and output

Optimized FEA model	YES, (Abaqus INP format)
Output surface checking, corrections, and simplification	YES
Output surface peaks and pits removal	YES
Output surface mesh subdivision and enhancement	YES
Output surface smoothing	YES
Output surface type	Closed surface
Output surface formats	STL, STEP, OBJ, AMF

FE mesh tools

Element conversion (from TTH10 and HXH8 to TTH4)	YES
Mesh quality improvement	YES, (TTH4 only)
Localized mesh refinement within volumes	YES, (TTH4 only)
Localized mesh refinement along surfaces	YES, (TTH4 only)
Element removal and mesh stripping	YES, (TTH4 only)
Mesh cleaning	YES, (TTH4 only)

Interactivity – options available during a running optimization process

Progress monitoring and visualization	YES
Changeable targeting options and values	YES

Activation and deactivation of individual load cases on the basis of their impact factors	YES
Automatic load cases management	YES
Activation or deactivation of semi-plastic behavior of materials and adjustments of the related parameters	YES
Adjustable tuning parameters	YES
Switching between single and double-precision FEA solver	YES
Pausing and continuing or restarting of the optimization process	YES

Computational efficiency and robustness	
Custom highly efficient finite elements	YES
Semi-active elements technology	YES
Robust and efficient semi-contact modelling	YES
Robust and efficient semi-plastic modeling	YES
Only high performance code	YES
High level of code parallelization	YES