CAESS ProTOp and ProTOpCI data sheet

Valid from: July, 2017

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] (ProTOpCI and ProTOp); single part only (models with more than one part are not supported)
INP by Simulia® Abaqus and SolidWorks® Simulation	YES[1] (ProTOp only); single part and single instance only (models with more than one part or instance are not supported)
GEO by SolidWorks® Simulation	YES[1] (ProTOp only); single part and single instance only (models with more than one part or instance are not supported)
DAT by Siemens NX™	YES[1] (ProTOp only); 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/CI documentation	

Optimization FEA model	
Elements	Special small-displacements and for topology optimization enriched elements: ▪ Tetrahedral (4 and 10 nodes) ▪ Hexahedral (8 nodes)
Materials	▪ Isotropic 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.

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

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	
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 type	Closed surface
Output formats	STL, STEP, AMF

Interactivity – options available during an active optimization session	
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
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 optimization sessions	YES

Computational efficiency and robustness	
Custom highly efficient finite elements	YES
Semi-active elements technology	YES
Smart start-from functionality	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