exaSIM™

Accelerating PRODUCTION

Subscriptions Now Available

3DSIM™

What is it?

exaSIM™ Software is a cloud-based Additive Manufacturing (AM) simulation tool that provides metal laser sintering users with rapid insight into residual stress and distortion predictions. These predictions are used to accelerate production through informed support generation and trend analysis; reducing trial and error iterations for successful builds. exaSIM is available in **GovCloud** for our customers who want access within an ITAR compliant environment. The AWS GovCloud (US) is ITAR, FedRAMP and DOD SRG compliant and is ISO 9001 / 27001 / 27017 / 27018 certified.

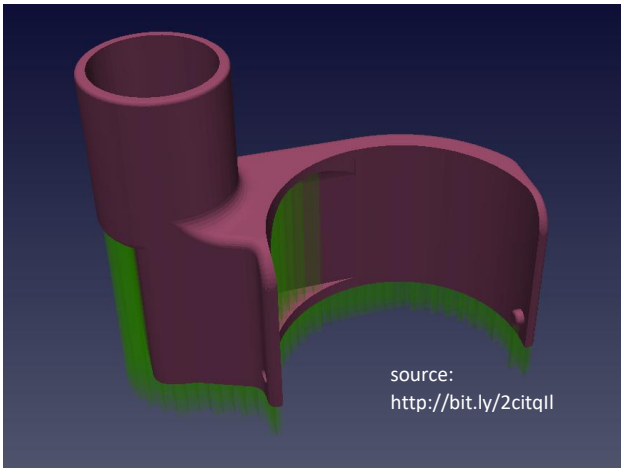
How does it work?

exaSIM™ utilizes advanced computational solvers to predict residual stress and distortion in a layer-by-layer fashion. A user supplied STL file is automatically meshed for analysis. A strain pattern is calculated and used to simulate how residual stress and distortion evolve as the part is being built. The maximum stress components are stored and used for support generation. Upon completion, exaSIM users are provided with stress contours for their part, multiple support options and distortion before and after removal from supports.

exaSIM™ offers three operational modes for predicting distortion and residual stress: ***1) Uniform Assumed Strain***, ***2) Scan Pattern Based Strain,*** *and* ***3) Thermal Strain***. Uniform Assumed Strain provides the fastest approximation by utilizing a uniform isotropic strain assumption. Scan Pattern Based Strain offers a higher fidelity solution by taking into account scan pattern based anisotropy. Thermal strain provides the highest degree of accuracy by predicting how thermal cycling affects strain accumulation. All modes can be used to generate supports and conduct trend analyses using linear elasticity or non-linear plasticity.

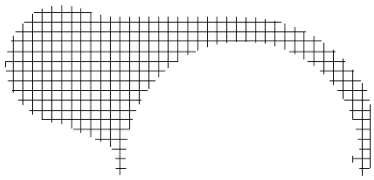
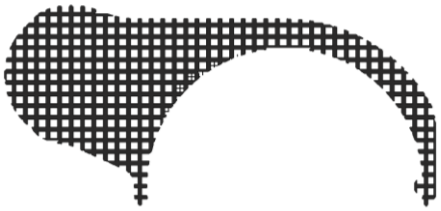
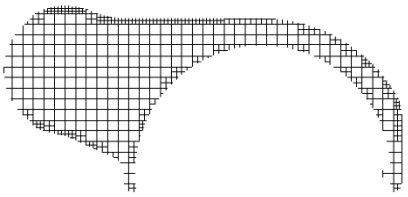
Support Generation:

The maximum residual stresses that supports must withstand are predicted using 3DSIM's Mechanics Solver and passed to the support generation module**.** Support structures are automatically generated based upon an algorithm which varies the support density to carry these maximum residual stresses. The resulting support structure is provided to the user, in an STL file format. A sample support structure is shown to the right *(green lines)*, where supporting walls for both internal holes and bottom surfaces were generated.



exaSIM provides three types of support structures. Thin wall supports are single-scan-width walls that are distributed beneath each downward-facing surface below a user-specified angle. Uniform supports are placed based upon geometric considerations only. Stress-based thin wall supports are distributed such that more walls are placed in regions of higher residual stress and fewer walls in regions of lower residual stress. Thick wall supports are uniformly spaced supports where the thickness of walls are increased in regions of higher residual stress. Each of these support types can be output as STL files for any exaSIM simulation.

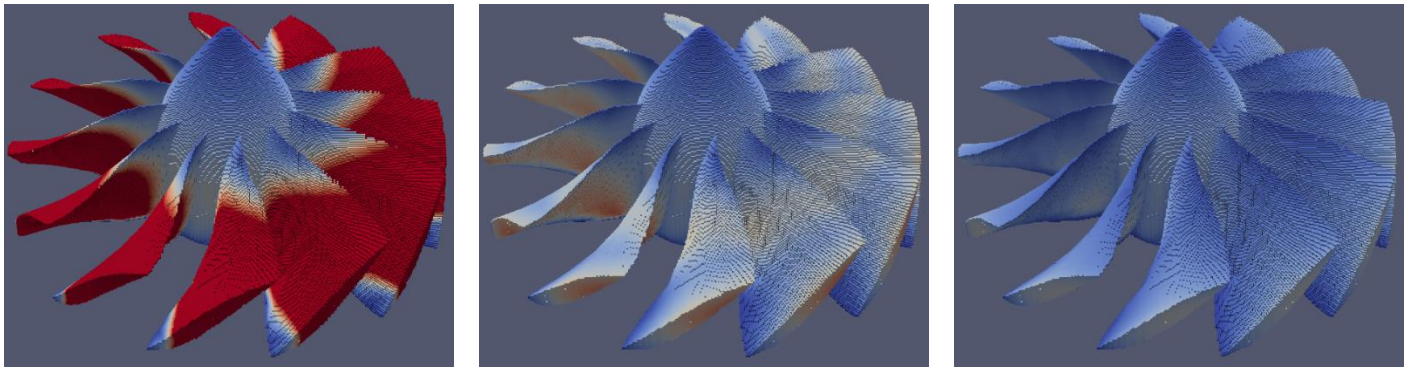
Example Support Structure Cross-Sections for the Part Discussed Above:

Uniform thin wall support	Residual stress-based thick wall	Residual stress-based thin wall
		

Trend Analysis:

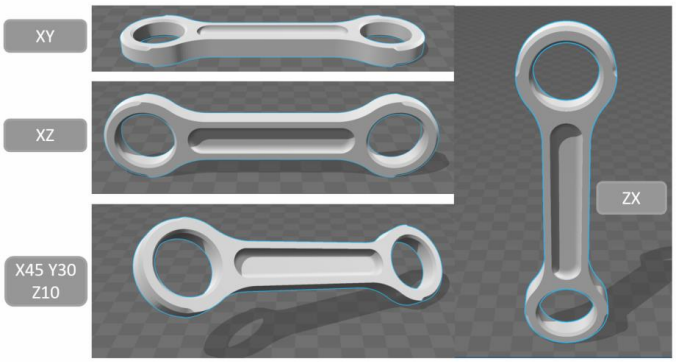
exaSIM users can select successful part orientations and support strategies by visualizing the effects of their assumptions on distortion and residual stress of as-built parts. Stress and distortion values are delivered to the user using the open source Visualization ToolKit (VTK) file format. These files can be viewed in many 3rd party visualization tools, including Paraview, a free viewer. VTK files enable users to see the differences between the original undeformed geometry and the final deformed geometry before and after removal from supports. Color maps can also be used for viewing distortion trends, final residual stress, and the maximum stress components throughout the build. These visualizations enable users to select the orientation and strategy which best meets their part design intent. By reducing maximum part stresses and distortion, users can reduce their likelihood for blade crash failures.

1) Comparative distortion analysis and support generation for different support angles



25° 45° 60°

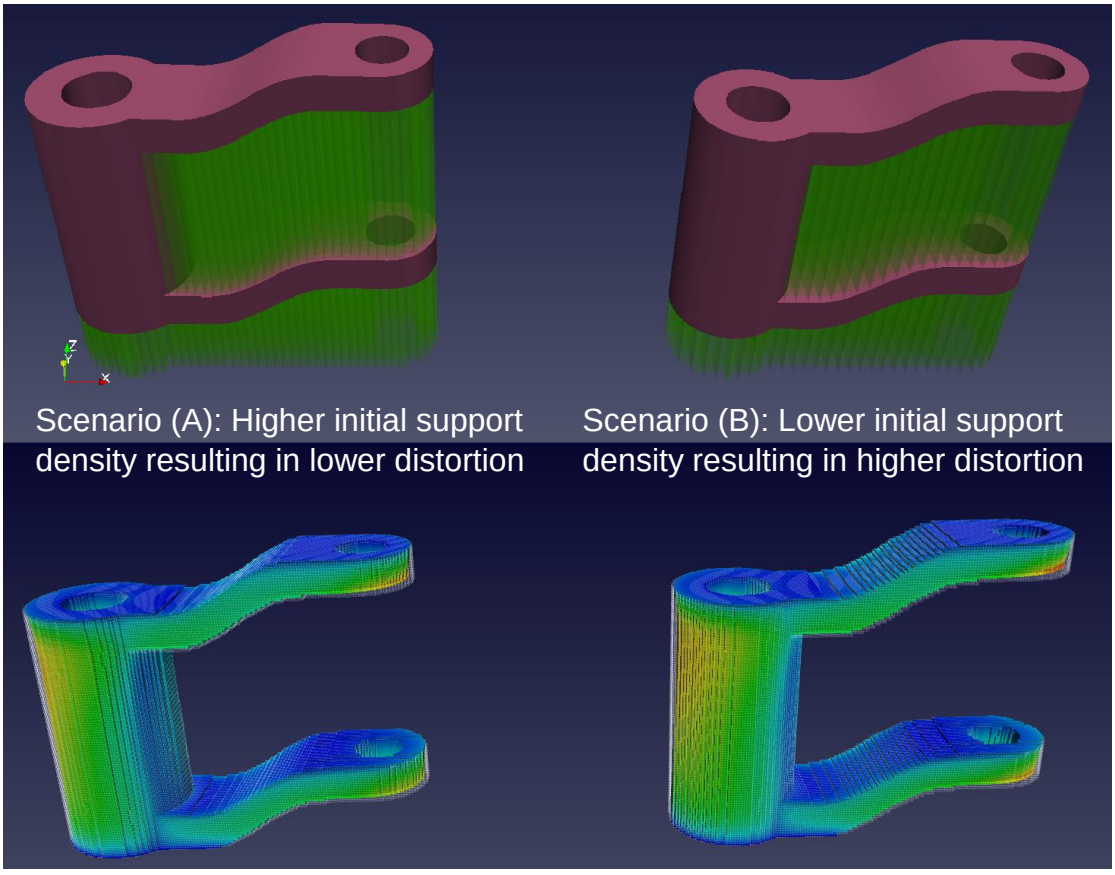
2) Comparison of stress and distortion trends based on part orientation



a) Various part orientations

b) σyy Stress Distribution

3) Comparison of distortion for varying support densities



Why Buy exaSIM?

exaSIM provides users with the ability to accelerate production. By simulating how changes in part orientation, support strategies, scan pattern, and more affect their final part, exaSIM users can significantly increase their chances for successful builds. Additionally, new features coming soon include ***Blade Crash Detection*** and ***Support Failure Predictions.***

Pricing

FEATURE LIST	exaSIM BASIC $750/Mo $7,500/Yr	exaSIM ADVANCED $1,100/Mo $11,000/Yr	exaSIM COMPLETE $1,600/Mo $16,000/Yr	exaSIM HOURLY $50*/Mo $20/Hour	exaSIM ENTERPRISE (contact us)
Auto-generated Supports (STL output)	✓	✓	✓	✓	✓
Distortion Before & After Support Removal (VTK output)	✓	✓	✓	✓	✓
Residual Stress Trends (VTK output)	✓	✓	✓	✓	✓
Uniform Assumed Strain	✓	✓	✓	✓	✓
Scan Pattern Dependent Strain		✓	✓	✓	✓
Thermal Strain			✓	✓	✓
Concurrent simulations**	1	1	1	2	customizable
User logins	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Community forum	✓	✓	✓	✓	✓
Email support	✓	✓	✓	✓	✓
User group participation	✓	✓	✓	✓	✓
Text message alerting for simulations	✓	✓	✓	✓	✓
Real-time simulation progress	✓	✓	✓	✓	✓
Cloud based access	✓	✓	✓	✓	✓
Allocated S3 storage limit	1 TB	2 TB	3 TB	1 TB	customizable
User-customized material assumptions	✓	✓	✓	✓	✓
Thermophysical material database***	n/a	n/a	1	1	customizable
Priority email support					✓
Phone support					✓
Onsite training					available
Dedicated technical success manager					available
AWS GovCloud					available

*** Includes 5 hours/month of simulation time; after which customers are billed $20/hour for simulations**

**** Concurrent simulation limit can be increased for $700/month or $7,000/year per instance**

***** Thermophysical material databases can be added for $200/month or $2,000/year per material**

Looking for a *Custom Configuration*? We will work with you to create a plan.

Interested in a *Demo* or a free trial? Email us at: info@3dsim.com