exaSIM™

Accelerating PRODUCTION

Beta Subscriptions Now Available

3DSIM

What is it?

exaSIM™ Beta 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.

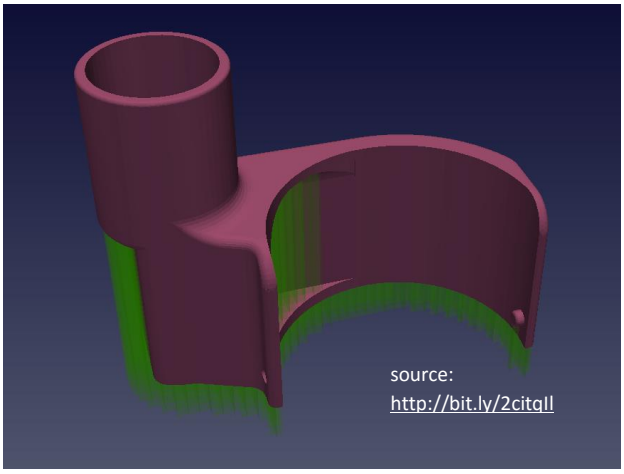
How does it work?

exaSIM™ Beta 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 and distortion for their geometry as well as multiple support options.

Our initial Beta release offers two operational modes for predicting distortion and residual stress: ***1) Uniform Assumed Strain*** and ***2) Scan Pattern Dependent Strain***. The Uniform Assumed Strain mode provides the fastest approximation by utilizing a uniform isotropic strain assumption. The Scan Pattern Dependent Strain mode offers a higher fidelity modeling solution by taking into account scan pattern based anisotropy. During our Beta program we will introduce a 3rd simulation mode, ***Thermal Strain,*** to provide the highest degree of accuracy. All modes can be used to generate supports and conduct trend analysis.

Support Generation:

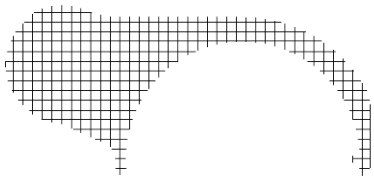
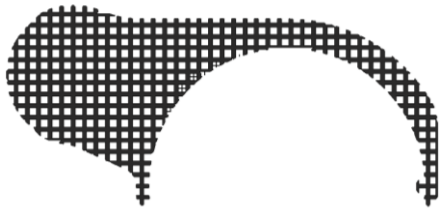
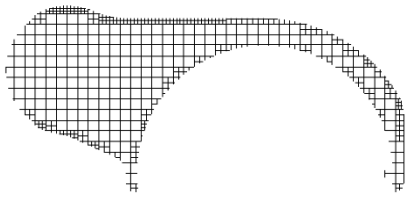
The maximum residual stresses that supports must withstand during part fabrication are predicted using 3DSIM's Mechanics Solver and passed to the support generation module**.** Support structures are automatically generated based upon an algorithm which varies the support density to carry these maximum 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 that is below

the user-specified minimum 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.

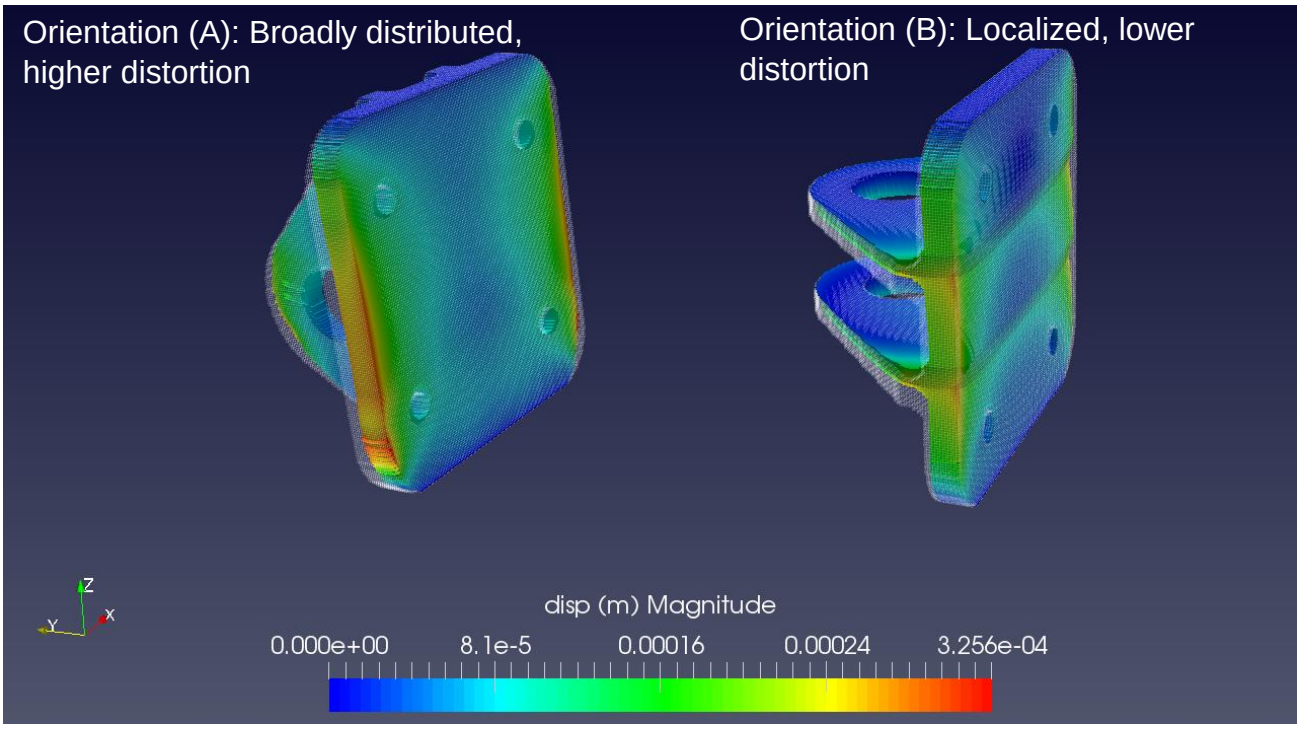
Example Support Structure Cross-Sections for the Part Discussed Above:

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

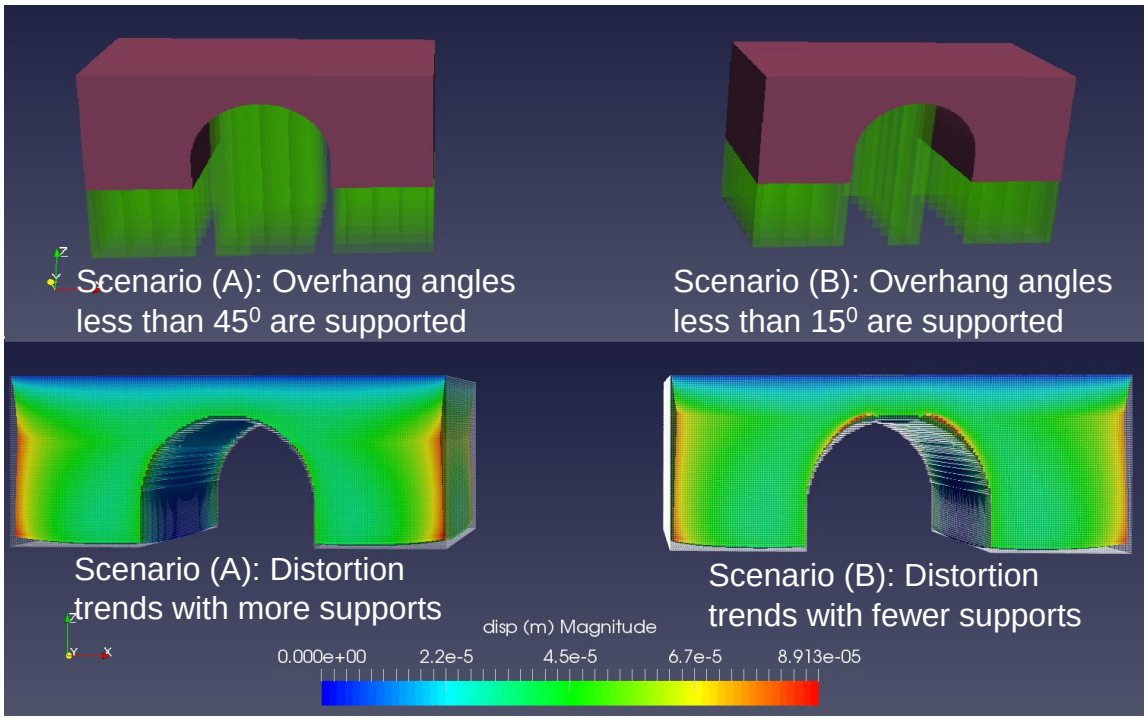
Trend Analysis:

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. 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.

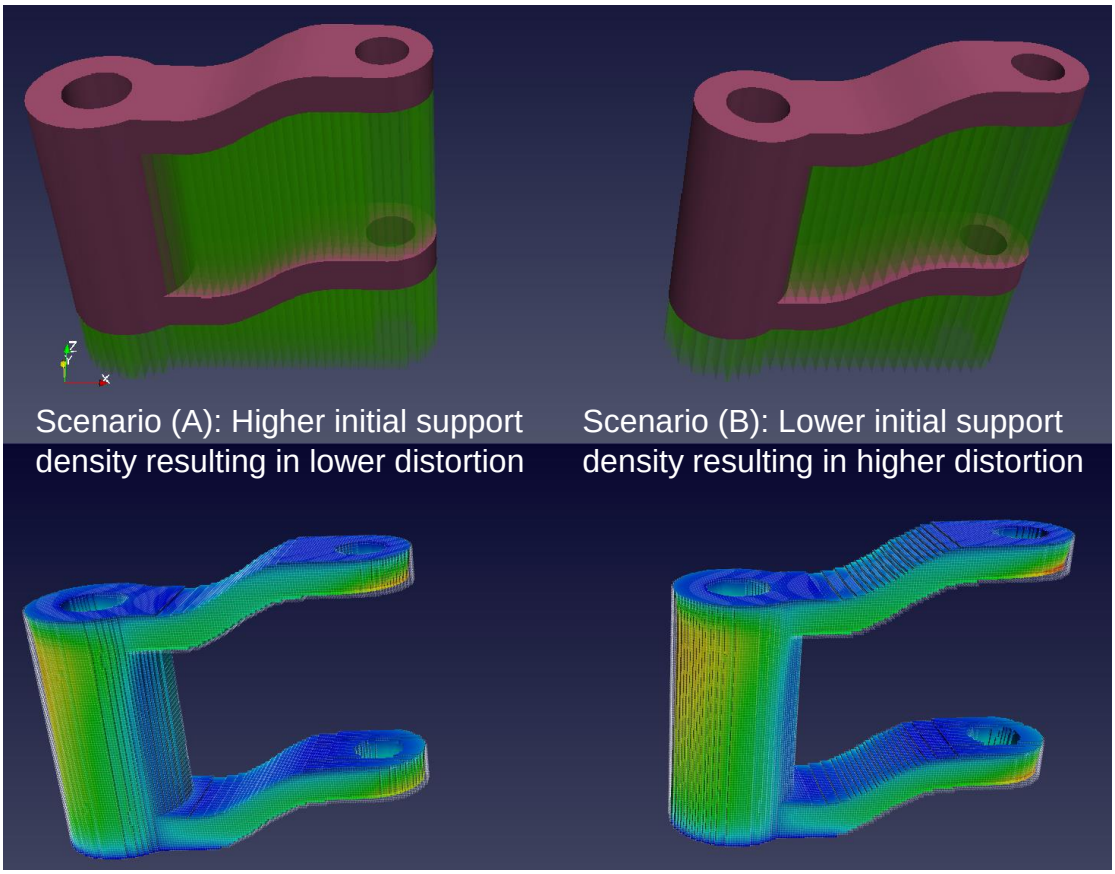
1) Comparative distortion analysis for different build orientations



2) The effects of overhang angle assumption on placement of supports and part distortion.



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.