

# Simufact Additive

## Optimizing the Additive Manufacturing Process

### Overview

Simufact Additive is a powerful simulation environment for getting “right the first time” optimization of powder bed additive manufacturing processes for metals.

This simulation tool allows accurate prediction of the distortion and residual stresses in the printed part and provides the needed guidance for design and manufacturing process modifications to ensure that a quality part is manufactured from the very first time. Simulation with Simufact Additive enables users optimize the 3-D printing process to reduce time and material waste.

#### Why use Simufact Additive as part of your AM process?

##### Quickly analyze your entire AM process

- Rotate and position a part
- Study support structure placement to minimize sag and eliminate collapse
- CAD to Finite Element Model – Easily transform Digital Geometry to Finite Element Mesh that captures the geometric requirement. Supported formats include:
  - STL, Parasolid, CATIA, STEP, and other conventional CAD formats

##### Quickly and accurately simulate and optimize parts

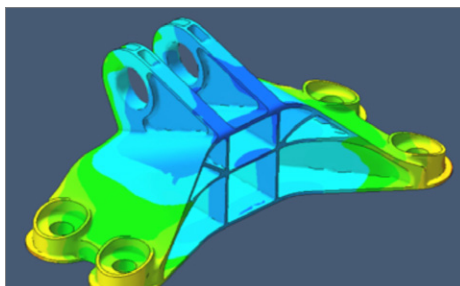
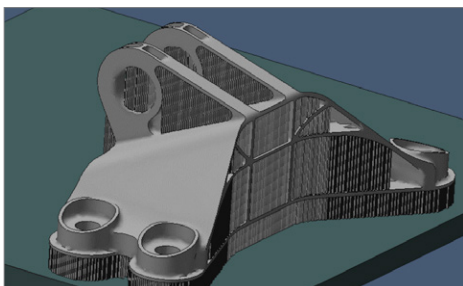
- Study the deviation from desired shape
- Compute residual stresses at each stage of the AM process
- Calibrate manufacturing strains
- Prediction of optimal initial pre-distorted shape

##### Optimize post-manufacturing processes

- Detachment from baseplate
- Influences of heat treatments to remove residual stresses
- Mechanical Influence of hot isostatic pressing (HIP)

##### Manufacturing Processes Addressed with Simufact Additive

- Selective Laser Sintering (SLS)
- Selective Laser Melting (SLM)
- Direct Metal Laser Sintering (DMLS)
- Electron Beam Melting (EBM)



Virtually optimize additively manufactured parts

### Capabilities

#### Powder Bed Processes

- Selective Laser Sintering (SLS)
- Selective Laser Melting (SLM)
- Direct Metal Laser Sintering (DMLS)
- Electron Beam Melting (EBM)

#### Create Model for Process Simulation

- Fast Mesh Creation
  - Correction for Partial Voxels
  - Accurate volume calculation
- Support Structure Creation
- Smart Data Structures
- Hatching Pattern – Layer Basis

#### Predict the Effects of Manufacturing Process

- Inherent Strain
  - Via Test Specimen
  - Simufact Welding
  - Marc
- Simulation
  - Part Distortion
  - Residual Stress build up

#### Simulate Post-Manufacturing Stages

- Multi-stage Manufacturing
  - Cutting
  - Removal of Supports
  - Heat treatment
  - Hot Isostatic Pressing
- Design Iteration for improved process

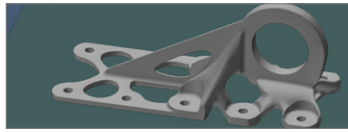
#### Post-Simulation Structural Analysis with MSC products

- Linear
- Nonlinear
- Modal

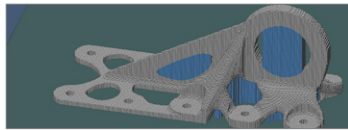
# Additive Manufacturing Workflow with Simufact Additive

## 1 Import Geometry and Create Mesh

Import the CAD geometry and generate a high quality voxel mesh.



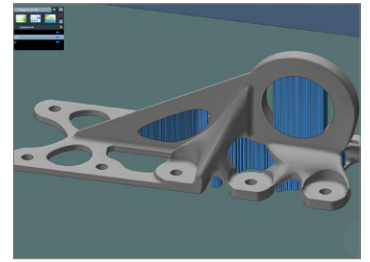
Imported geometry



Voxel mesh

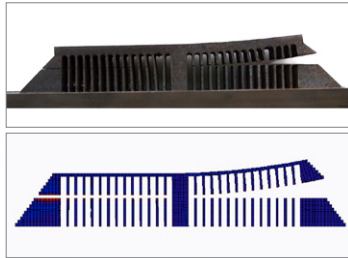
## 2 Generate Support Structures

Create supports needed for a more stable part, especially with steep overhangs and cantilevered sections.



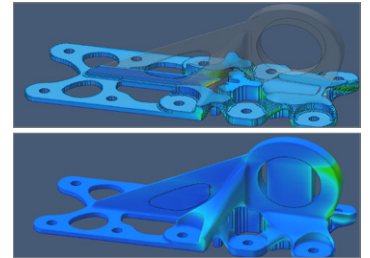
## 3 Calibrate Manufacturing Strains

Calibrate the simulated manufacturing strains to closely match with test data.



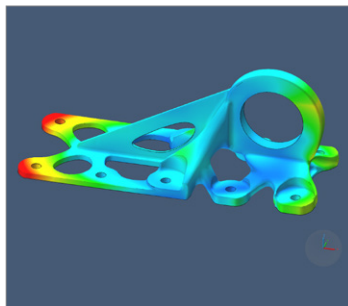
## 4 Simulate Multi-stage Printing Process

Predict residual stresses and deformations that could affect the mechanical performance of the part.



## 5 Simulate Post-Manufacturing Steps

Perform post-printing activities (e.g. part detachment, heat treatment and pressurization) to relieve residual stresses and cut the final part from manufacturing aids.



## 6 Optimize Process

Iterate orientation, support structures, and pre-deformation to reduce stresses and geometry deviations from desired shape.



Distorted geometry after printing



Geometry compensated for distortion