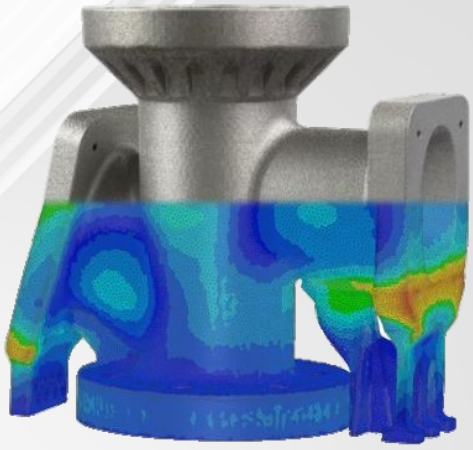
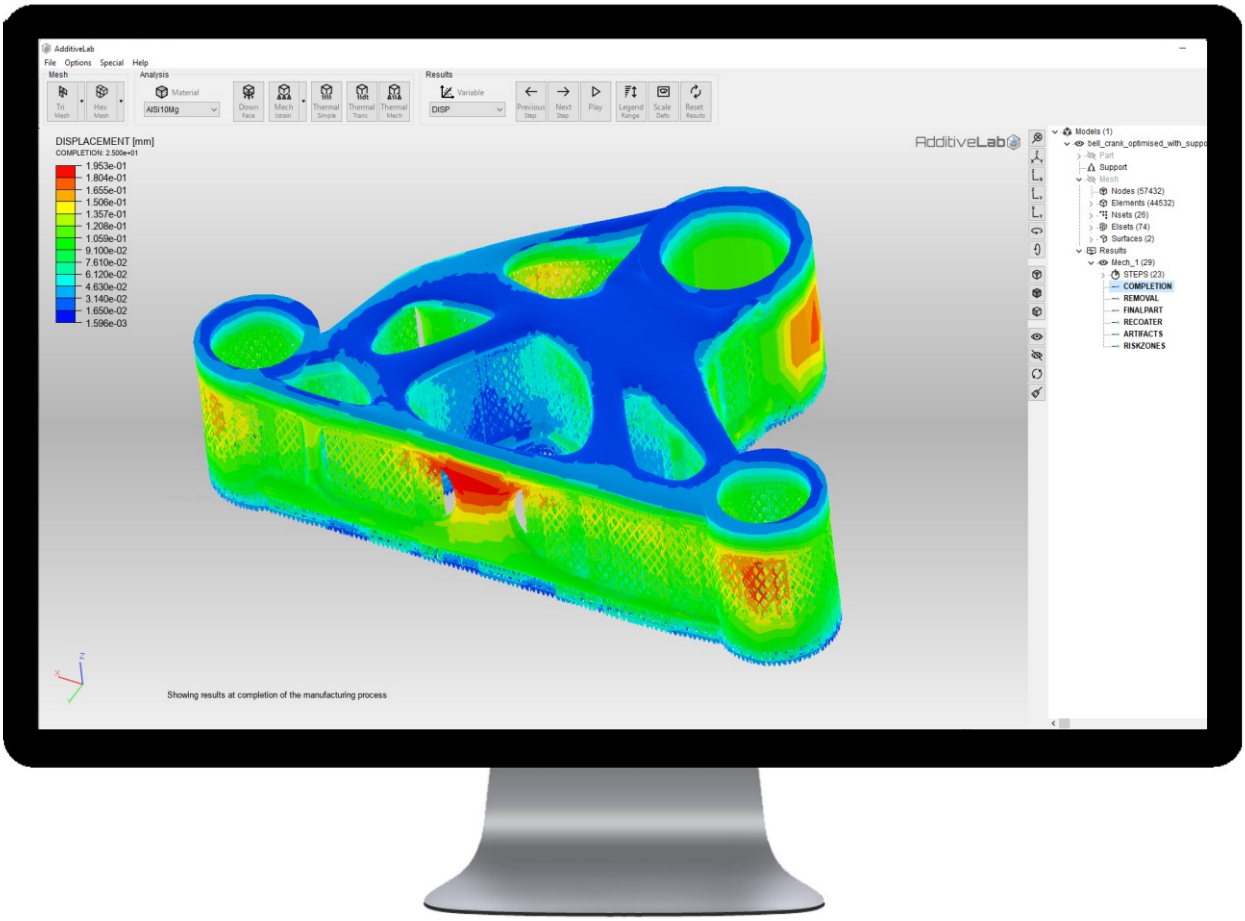
AdditiveLab

Metal Additive Manufacturing Simulation.



AdditiveLab Product Brochure.



www.additive-lab.com

Simulation for Metal AM.

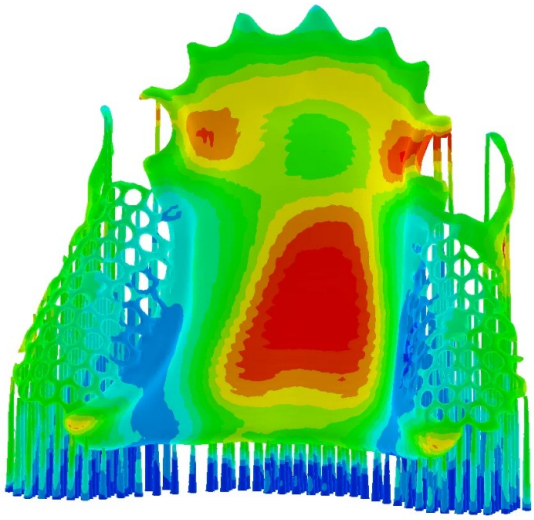
The use of Metal Additive Manufacturing (AM) to replace traditionally manufactured parts has gained increased attention in the last decade. Highly complex parts manufactured with AM allow for optimized designs tailored to specific application needs. These AM parts surpass inferior designs from traditional manufacturing in terms of higher efficiency, better performance and eventual cost cuttings. In the early phase of adapting AM technology, researching new materials and working with complex designs, companies commonly spend several weeks with trial-and-error tests to find configurations that succeed. This is inefficient and a waste of time and money.

The AdditiveLab software solutions help to cut back the trial-and-error tests by providing simulation technology that can predict potential manufacturing outcomes of AM processes and give better insight into production behaviour. With the AdditiveLab software, failure-prone regions can be identified and machine parameters can be optimized to increase the manufacturing success, and subsequently, save time and money.

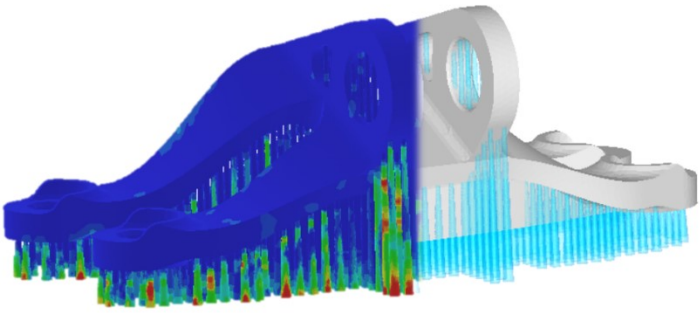
AdditiveLab LITE.

Simple usage.

AdditiveLab LITE was particularly developed to address the needs of AM engineers without requiring simulation knowledge. It provides a very simple user-interface and highly automated model preparation processes, reducing the state-of-the-art AM process simulation to only a few clicks.



Deformations predicted as red zones in AdditiveLab via mechanical analysis.



Critical Stress zones increasing the risk of build failure are highlighted in red on part, support configuration via AdditiveLab mechanical analysis

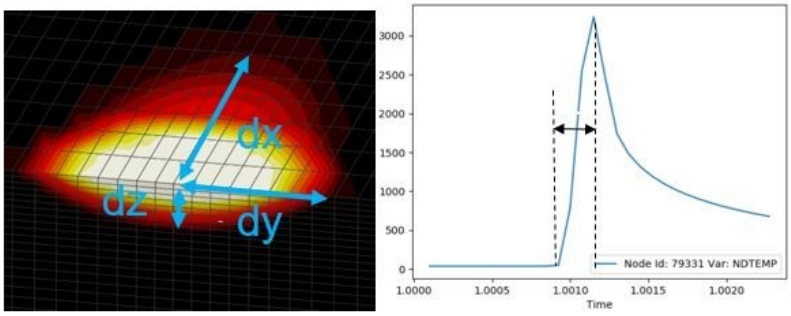
Clear insight.

AdditiveLab LITE empowers users to investigate, understand and learn more about their manufacturing processes. The visual feedback of simulation results in AdditiveLab allows to quickly identify *critical regions*: regions that suffer from large deformations, localized stress concentrations, recoater collisions, cracks and excessive temperatures.

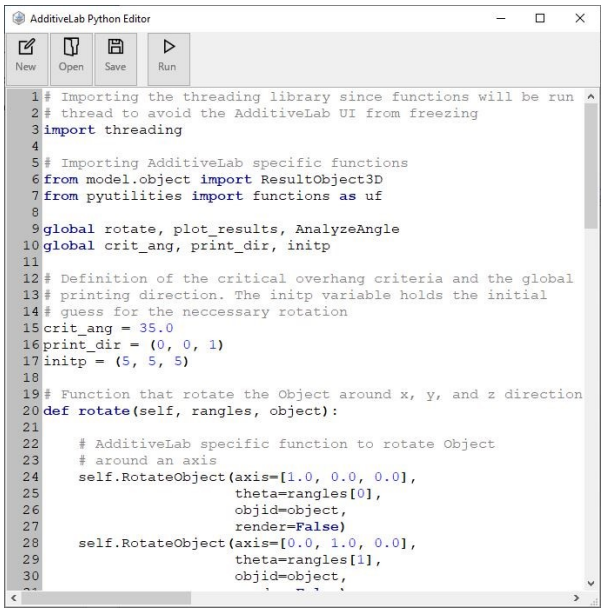
AdditiveLab RESEARCH.

Powerful.

AdditiveLab RESEARCH enables simulation engineers to perform AM process simulations from micro to entire build-configuration scales. It supports a variety of simulation modules including thermal and thermo-mechanically coupled analyses with fast execution times thanks to multi-core CPU support.



The temperatures in a cross section cut to measure the melt pool dimensions (left) and the temperature vs. time plot queried at the center of the simulation model.




```
# Importing the threading library since functions will be run
# thread to avoid the AdditiveLab UI from freezing
import threading

# Importing AdditiveLab specific functions
from model.object import ResultObject3D
from pyutilities import functions as uf

global rotate, plot_results, AnalyzeAngle
global crit_ang, print_dir, initp

# Definition of the critical overhang criteria and the global
# printing direction. The initp variable holds the initial
# guess for the neccessary rotation
crit_ang = 35.0
print_dir = (0, 0, 1)
initp = (5, 5, 5)

# Function that rotate the Object around x, y, and z direction
def rotate(self, rangles, object):

    # AdditiveLab specific function to rotate Object
    # around an axis
    self.RotateObject(axis=[1.0, 0.0, 0.0],
                      theta=rangles[0],
                      objid=object,
                      render=False)
    self.RotateObject(axis=[0.0, 1.0, 0.0],
                      theta=rangles[1],
                      objid=object,
```

AdditiveLab Python API editor

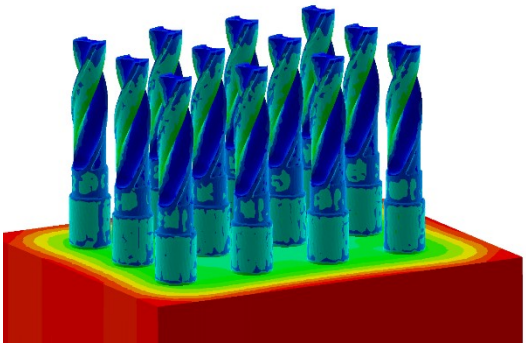
Programmable.

The integrated Python API gives users full access to all the extensively documented simulation features and functions. It empowers users to write their own scripts to automate and innovate. Developed scripts can be distributed for further use within the organization allowing to share knowledge and strengthen IP.

AdditiveLab LIBRARIES.

Accessable.

Our company offers AdditiveLab's powerful simulation via libraries. Software solution providers can integrate the AdditiveLab LIBRARIES in their own solution offerings. AdditiveLab LIBRARIES are optimized for desktop applications as well as cloud-based solutions. The scalable and easy to integrate libraries propose a unique opportunity for companies expanding their product scope and providing better solutions for their customers.

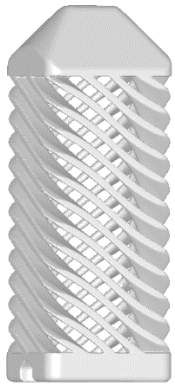


Simulation of full Build-platform showing the Displacements distribution using AdditiveLab LIBRARIES.

Case Study:

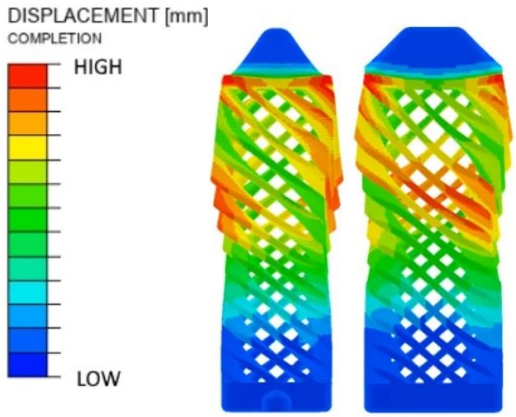
Prediction of Excessive Deformations and Simulation-Guided Production.

Challenge 1:
Simulate the AM process of an innovative spinal fusion cage design from Tangible Solutions. Predict critical deformations observed in production.



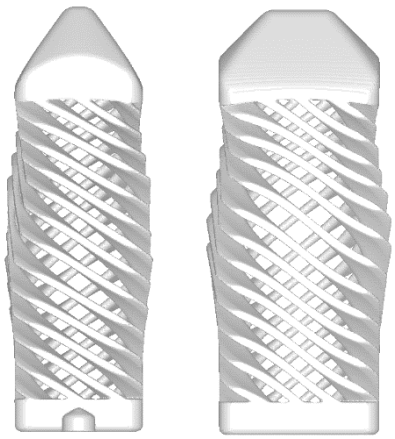
Original Spinal Cage design.

Production result of Spinal Cage showing the Displacement distribution; left: lateral view, right: frontal view (Courtesy of Tangible Solutions)

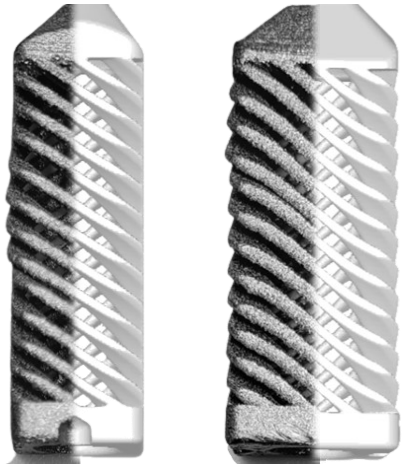


Simulation of Spinal Cage showing the Displacement distribution via AdditiveLab mechanical analysis; left: lateral view, right: frontal view

Challenge 2:
Generate a Counter-Deformed design based on predicted deformations that leads to successful production.



Simulation driven Counter-Deformed design of Spinal Cage via AdditiveLab; left: lateral view, right: frontal view



Production result of Counter-Deformed Spinal Cage showing the Displacement distribution; left: lateral view, right: frontal view mapped against original part design (Courtesy of Tangible Solutions)