SIMULATION OF RESIDUAL STRESS AND DISTORTION OF ADDITIVELY MANUFACTURED COMPONENTS

Parametric Additive Layer Manufacturing (ALM) simulation workflow for calibration and optimization of the manufacturing process with ANSYS optiSLang

Analysis Task

The Dynardo ANSYS optiSLang ALM workflow enables the simulation and prognosis of component stresses caused by 3D printing, such as temperature fields, deformations (distortions), residual stresses, irreversible strains or possible cracking.

Solution Methodology

The workflow can process arbitrary geometries for printing, slicing (seperation of printing layers) and thermo-mechanically coupled simulation of the additive layer manufacturing process.

The entire thermal-mechanical simulation workflow is parametrically built. Thus, process, discretization and material parameters can be varied and made available for impact examination in sensitivity analyses or robustness evaluations. The results are then used for calibration and optimization.

optiSLang automatically identifies the relevant input and output parameters and quantifies the predictive capability using the Coefficient of Prognosis (CoP) and the Metamodel of Optimal Prognosis (MOP).

Another special option of the simulation workflow is the implementation of an anisotropic, elasto-plastic material model for printed metals as a key to real-life residual stress and crack prognosis.

Customer Benefits

Virtual process optimization using ALM simulation prevents time-consuming trial & error tests by:

- Prediction and minimization of residual stresses and distortion of components
- Prediction and optimization of temperature development in components and base plate
- Predicting and avoiding the risk of cracking caused by the manufacturing process
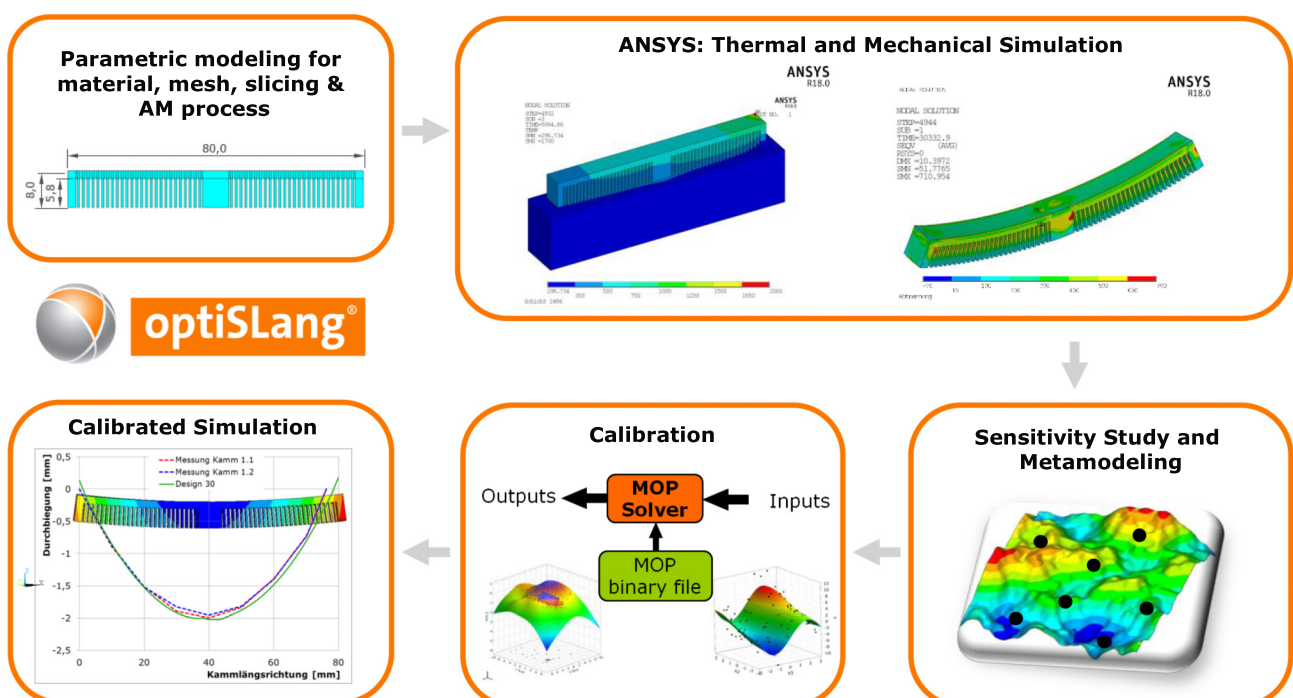
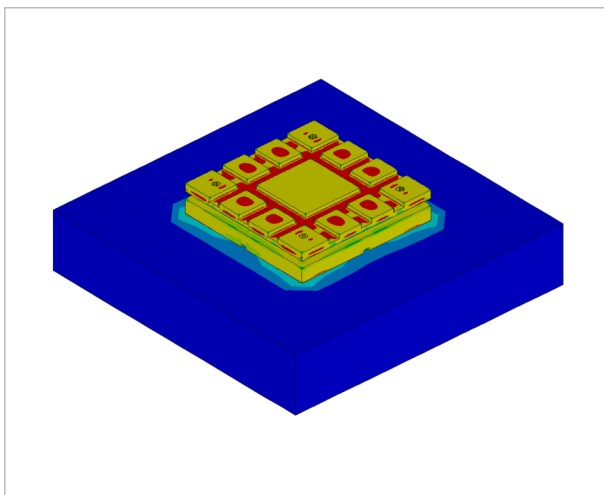ANSYS optiSLang ALM Calibration Workflow
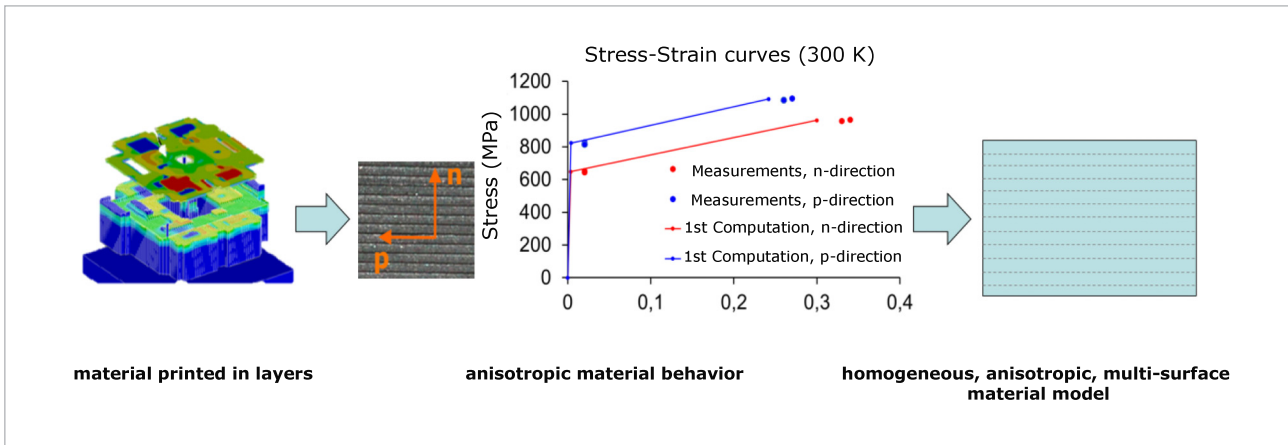
Anisotropic Layer Printed Material Model

- Simulation and target-oriented planning of post-treatment processes
- Optimization of process parameters, component placement and support structures
- Quantification of risks using sensitivity analyses, identification of optimization potential
- Coupling of component and process optimization, shortening of development times, reduction of development costs
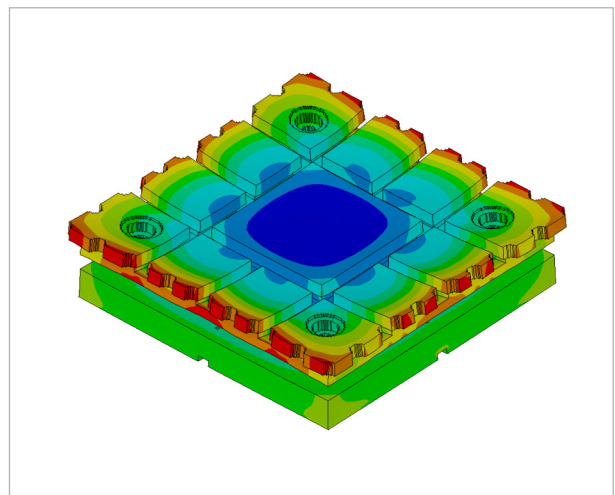
Dynardo supports you with over 17 years of experience regarding targeted software solutions and consulting services with ANSYS and optiSLang for additive manufacturing.
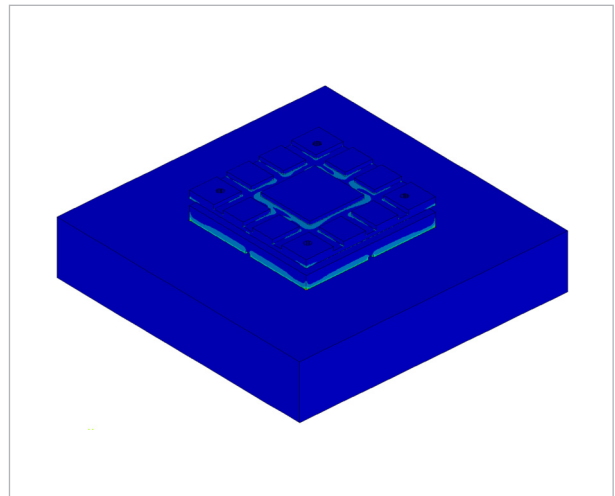
Plastic Strain

Residual Stresses

Distortion