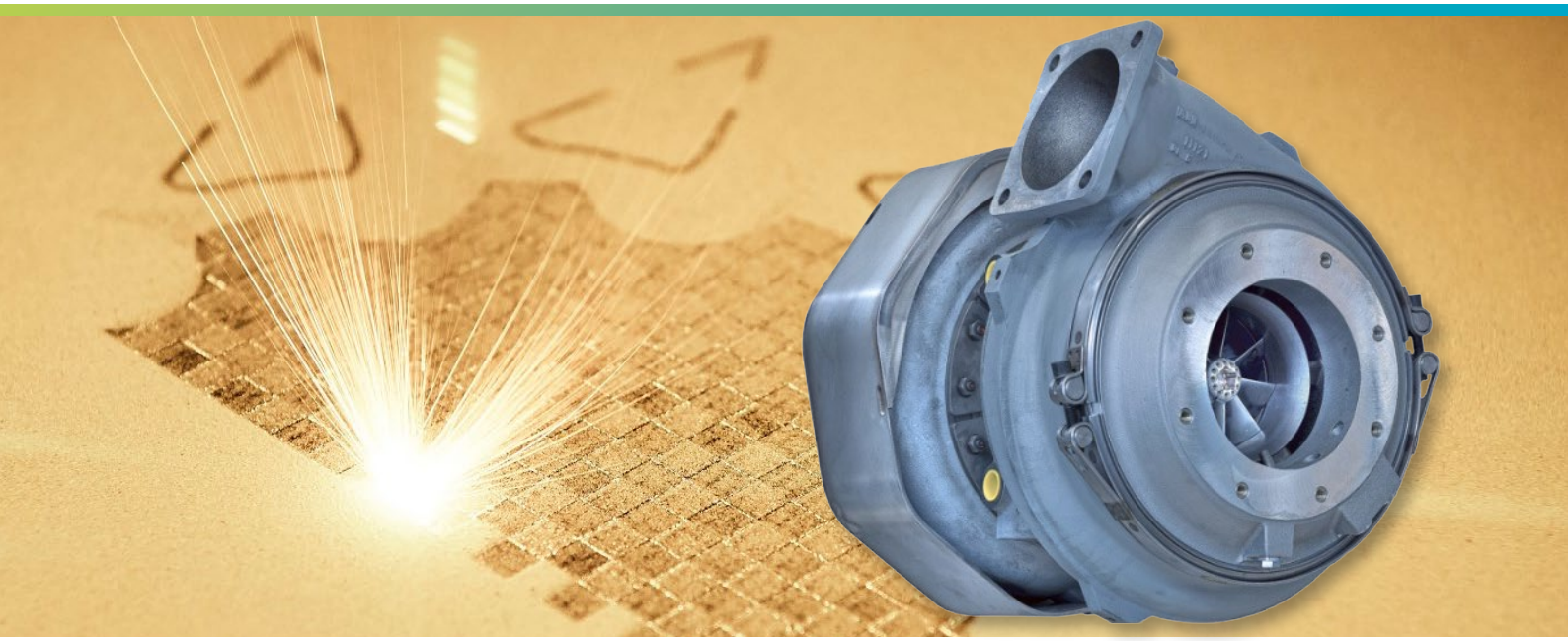
HEXAGON | simufact

toolcraft Case study

Flexibility through additive manufacturing: How simulation supports 3D prototyping

Simufact and its technology partner toolcraft shows in a best practice case how additive manufacturing helps to save time and money in the production of prototypes.



MBFZ toolcraft GmbH from Georgensgmünd in Middle Franconia has optimized together with its software partner Simufact Engineering from Hamburg the additive production of a turbine wheel from ABB Turbo Systems AG.

Typically, these components can be found in drive units of heavy machines and vehicles, such as diesel locomotives, off-highway trucks or dump trucks. Depending on the application, manufacturers require the component to have a long service life and high wear resistance so that it can withstand mechanical and thermal loads.

Challenge:

Transfer prototyping into serial manufacturing. Using the example of a filigree blade geometry we consider the challenges of traditional manufacturing.

Solution:

Generate variant diversity with the help of additive manufacturing. This technique helps you save time and money. Reach the first-time-right approach through simulation.

Used products:

Simufact Additive

Customer:

MBFZ toolcraft GmbH

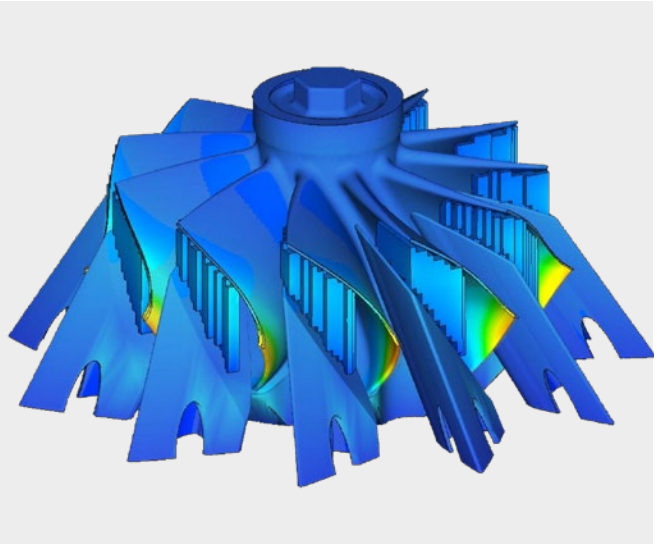


Image 1: Simulation helps to reduce component distortion and thus to keep tight tolerances.

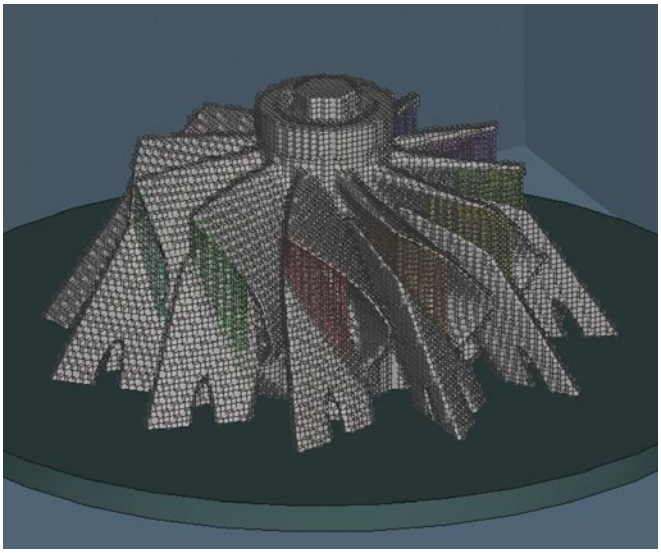
From prototype to series

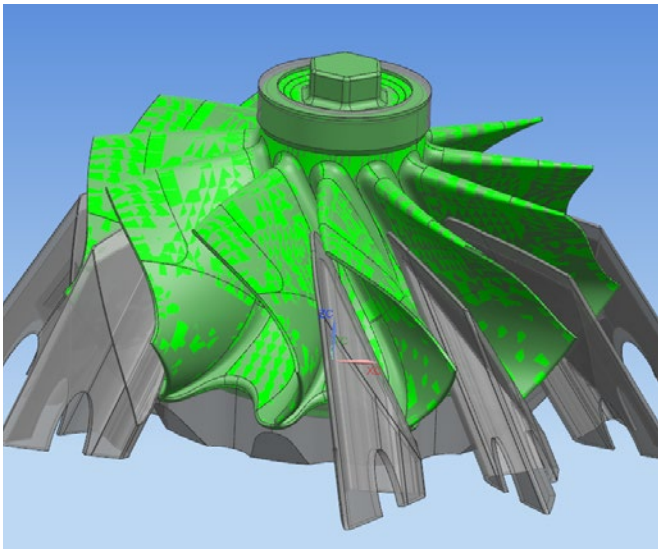
Take a view on manufacturing and its challenges in serial manufacturing

Filigree blade geometries are typically produced by casting processes as an economical and robust production process suitable for series production. However, before a new blade geometry can be used with the required properties, many tests are required for which prototypes or small batches of blades are required. In exceptional cases - depending on the number of parts required - the turbine blades required for testing can also be produced by casting in very small series. In general, these processes are very time-consuming and cost-intensive and therefore not much more than two prototypes are available to develop the final product for use in series turbines.

At this point, additive manufacturing has become a key technology that saves time and money. Furthermore, the technology offers a maximum flexibility, one of the most important requirements in the field of prototyping. With the help of this innovative manufacturing process, a variety of turbine blades can be produced in a very short time, which ultimately leads to a better product.

This is where toolcraft‘s high manufacturing competence throughout the entire value-added chain in turbine blade production proves its worth. Within the framework of the cooperation between toolcraft and ABB Turbo Systems AG, the products can be designed and implemented as 3D printing right from the start.





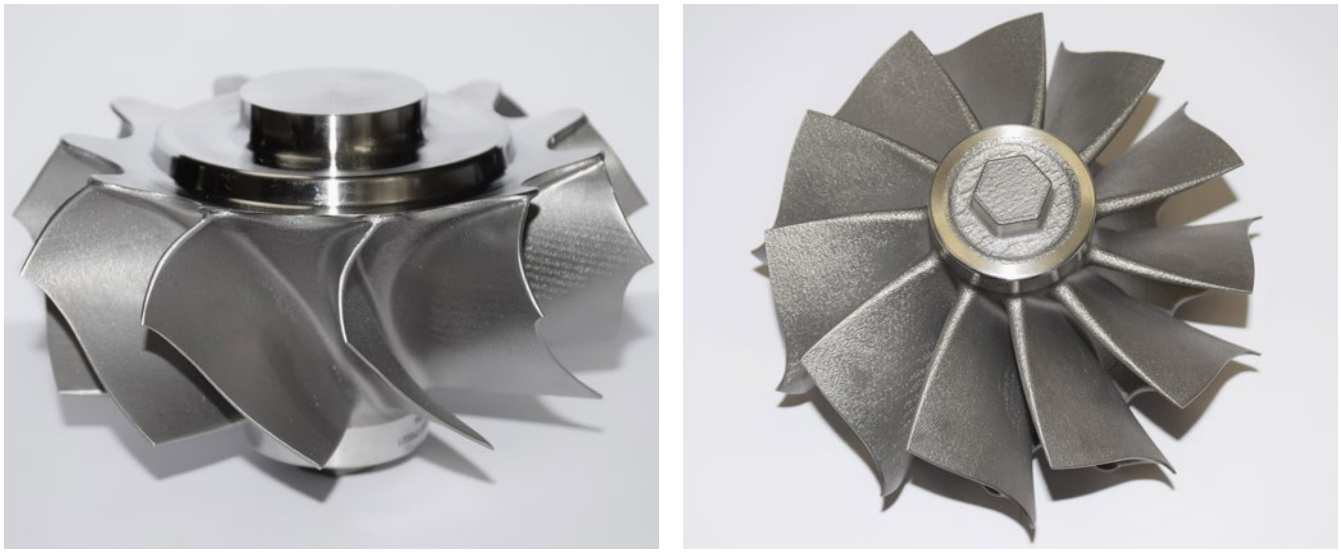


Image 2: From design to simulation to the finished component – less distortions thanks to Simufact Additive.

Simulation provides reliable information on distortion and stresses in the component

For toolcraft, the greatest challenge in manufacturing prototypes is maintaining the required tolerances and dimensional accuracy. The decisive factor here is the component distortion caused by the AM process. In order to keep the distortions as low as possible, toolcraft relies on Simufact Additive. By using the user-friendly and process-oriented simulation solution, toolcraft makes it possible to significantly minimize distortions by means of suitable process parameters and to compensate where they cannot be avoided. In this way, toolcraft can meet all required tolerances, thus eliminating the need for time-consuming reworking.

Problems and Challenges in the Building Process

A closer look at the building process clearly reveals the challenges and problems. Due to component geometry and thermal stress, high stresses occur during the building process. This is due to the special features of the geometry, which on the one hand has a solid core with a lot of material and volume, while on the other hand the blades are very filigree. As a result, there are large cross-sectional changes in the component, which favour the residual stresses during the manufacturing process. These in turn result in a high susceptibility to distortion.

toolcraft solves this problem with a careful simulation-based as-is analysis in which critical areas are identified. From this, the necessary measures can then be derived to counteract the distortion problem. This includes the development of suitable support structures that generally minimize distortion and thus ensure a safe construction process. But the ideal alignment of the components to be printed on the base plate can also be very helpful in individual cases. The last step is an automated compensation of the remaining distortion based on a quantitative distortion analysis, with which the remaining distortion is determined. The results obtained in this way can be used to derive the print preparation. Thanks to the simulation, toolcraft achieves a low-distortion component structure and can thus remain to its „first-time-right“ approach - to fulfil all requirements on the component with the first print. The use of additive manufacturing enables toolcraft to react flexibly and quickly to customer requests, such as design changes, and thus to significantly reduce project lead times. The virtual engineering offered by the powerful simulation solution enables significantly tighter processes in the process development of 3D printing projects. This approach can be realized through the reliable software Simufact Additive.

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