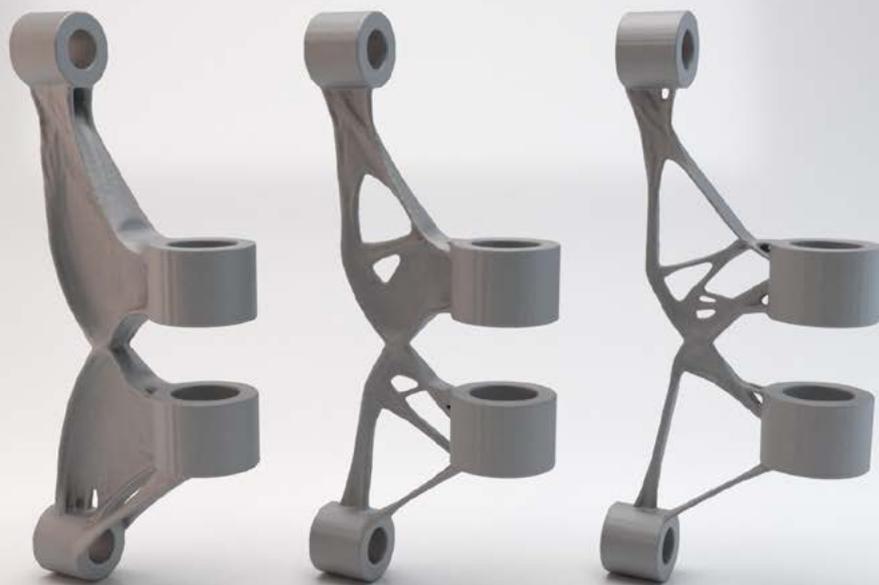


# Generating competitive 3D printing designs for simple parts over lunch time

Today's production costs for additive manufacturing require designs that are cutting the edge



**3D printing has a high potential with its production flexibility and geometry freedom. Yet, it is difficult to be competitive with traditional manufacturing technologies. More economic designs can be created by optimisation but until now this has been a complex process. MSC Apex Generative Design is here to change that.**

Now that Additive Manufacturing has reached mainstream and is implemented more and more in manufacturing centres all around the world, new software solutions for design generation and optimisation are needed to exploit the potential of this new manufacturing process. Apart from niche applications, it is quite difficult to identify use cases where AM can be competitive with traditional manufacturing technologies. A highly sophisticated design is required to drive down AM costs. So far though, the process of manually adapting conventional designs has involved both a very high amount of work and a high amount of expertise. MSC Software makes this process easier now with MSC Apex Generative Design, and with its semi-autonomous workflow, creating new designs easier than ever.

## The challenge

To put this to the test, MIBA Sinter Austria GmbH, a technology leader for powder metallurgical applications, decided to optimise the hinge on a sintering furnace. Due to the lower number of pieces being manufactured, MIBA determined it was a good candidate for additive production. Yet, the very simple application and part design would not have been a feasible candidate for a complex optimisation. It usually does not appear to be economical, since the optimisation process is so time-consuming – and manual construction with technology-specific experience would therefore be necessary.

With MSC Apex Generative Design 2020, this assumption could be broken, since MIBA was able to start and finish the complete optimisation within an hour.

## The solution

The significantly more efficient workflow of MSC Apex Generative Design realizes considerable time savings compared to existing optimisation solutions and manual part design. With a drastic reduction of the optimisation and development time, it is now also profitable to optimise simple parts as well as complex optimisation models. The successful cooperation between MSC Software and MIBA Sinter Austria GmbH shows that this can also be implemented cost-efficiently in practice.

The existing hinge CAD data was first imported into MSC Apex Generative Design. The design and non-design areas required for optimisation were created directly within the

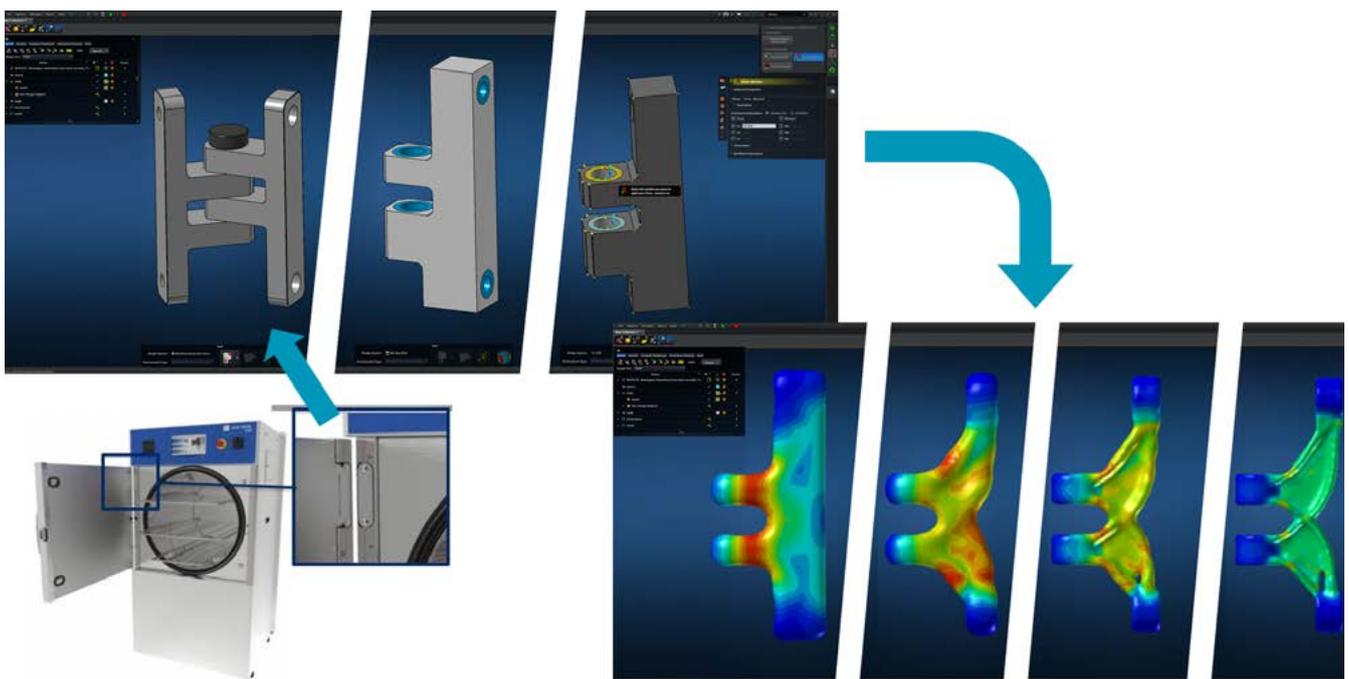
software with just a few mouse clicks, due to the tool's integrated modelling functions. Non-design-areas such as connection and force introduction points, remained unchanged.

The engineers then defined the optimisation parameters and the maximum stress value in a few different scenarios, so that a variety of optimised design candidates could be generated.

## Optimisation almost in real-time

Once the simulation process began, the software automatically created a mesh within seconds. Due to the automatic adjustment of the mesh resolution, the first optimisation iterations were run through within seconds, and as the iterations increased in complexity, the mesh began to refine automatically, and thus began slowing down a bit, up to a few minutes for each iteration. Yet, no user interaction is required during the optimisation process as all intermediate steps are conducted by the software.

During the simulation process each iteration is visualized and displayed in the user interface in real-time so the user can always check the design direction for feasibility. If the users do not like what they see during each iteration of the optimisation, they have the ability to react immediately to possible errors in the model setup and correct them. To speed up the optimisations, MSC Apex Generative Design can calculate on graphics card (GPU), and remote solving on compute servers is also possible. These two options can increase the simulation performance even further.



The existing design is imported directly into the software and prepared for model construction with a few clicks. During simulation, the progression of each iteration is shown to check the progress, which can be seen above.

### Key highlights:

Product: MSC Apex Generative Design, Simufact Additive

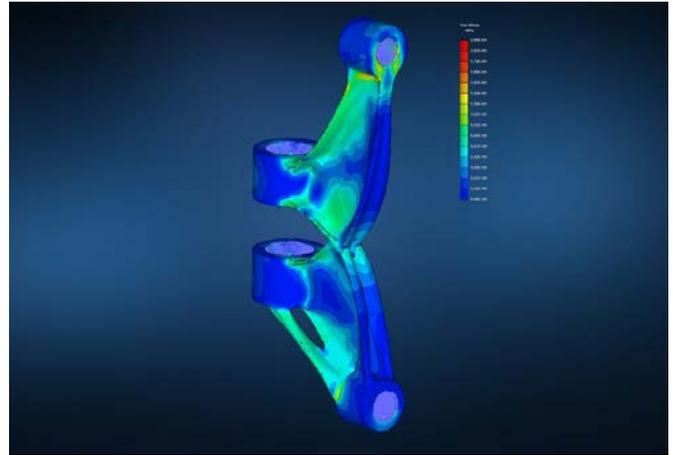
Industry: Machinery and equipment

Benefits:

85% weight reduction

40 min calculation time

Tailored for additive manufacturing



MSC Nastran Validation of the received optimised design

## The result

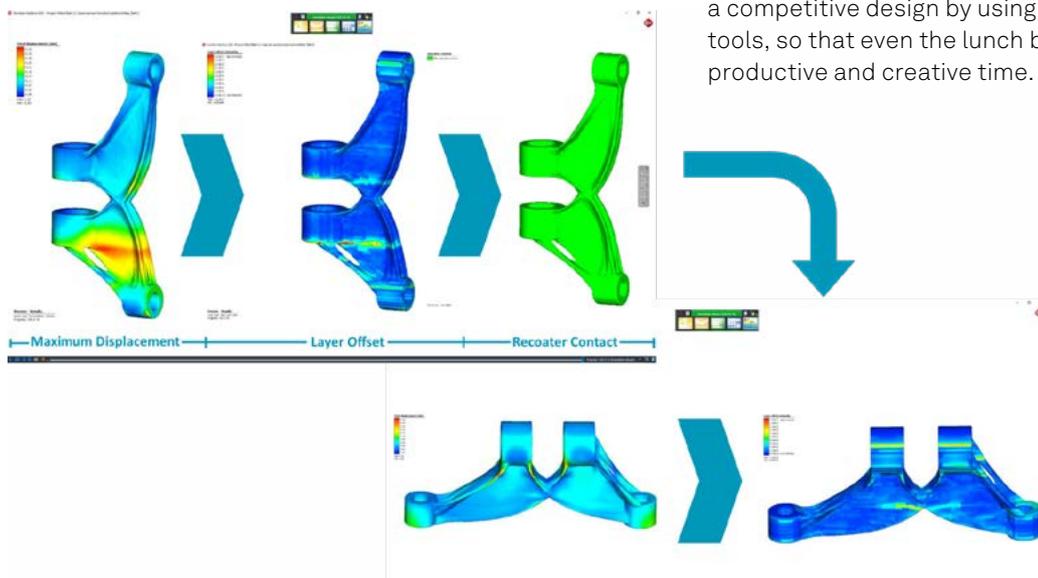
In the case of the above-mentioned hinge from MIBA Sinter Austria GmbH, the three design proposals (with different stress goals) resulted in a mass reduction for each hinge from 338 g to less than 40 g, significantly driving down production costs. This reduction results in significantly lower raw material usage and production time, thus immediately lowering production costs.

Dr. Martin Laher, Director for MIBA Sinter Austria GmbH, agreed: “To be more cost-effective, a redesign was absolutely necessary. With MSC Apex Generative Design 2020, we were able to show that printing time and costs could be significantly reduced, and we are now more competitive with additive manufacturing.” With a calculation time of just 40 minutes per design on a normal workstation, such applications in product development can be realized even over a lunch break and finalized within hours instead of weeks.

## Verification and manufacturing simulation

MSC Software’s Additive Design and Manufacturing workflow provided a highly fluent workflow for MIBA. Due to the good data communication between Design, Simulation, and Manufacturing software within the MSC Software additive workflow, the design result could be transferred into the renowned FEM solver MSC Nastran for certified validation, which allowed an immediate re-analysis of the resulting design without much manual effort. Since MSC Apex Generative Design allowed a direct import into the manufacturing simulation of Simufact Additive, the generated lightweight design was then optimised to the precise requirements of the 3D print. A shrink line would have occurred when manufactured upright, and with Simufact Additive, a different print position could be found, which not only prevented the shrink line, but also reduced the height of the build job and optimised support structure for a defect-free and cost-efficient production.

At the end of the day, MIBA Sinter Austria GmbH found a competitive design by using the appropriate digital tools, so that even the lunch break can become a highly productive and creative time.



Simufact Additive analysis showing a shrink line in the bottom area whereas in a different position the build height and displacement could significantly reduced



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Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

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