

A SUSTAINABLE ROBOT RETROFIT

REDUCING POWER CONSUMPTION AND SAVING RESOURCES VIA HARDWARE UPDATES

About the Customer

amprove, founded in 2019 and based in Stuttgart, Germany, is a service provider for the development of lightweight structural components for the industrial machinery industry, automotive industry, and others. The amprove team supports its customers from start to finish; from starting with the identification of use cases, to an economic feasibility assessment, to the selection of the ideal manufacturing process and development of the component, up to coordinating the manufacturing of the optimized part with manufacturing partners. Pursuing a simulation-driven development approach, amprove aspires to maximize each component's performance. To do this, amprove has been using Altair structural mechanics solutions - with a special focus on structural optimization.

Their Challenge

In addition to saving costs by reducing material usage, lightweight components lower production costs and reduce carbon dioxide (CO₂) emissions during component manufacture. To demonstrate the potential of lightweight design, amprove set out to develop a new, energy-efficient pick-and-place robot. In addition to choosing the best manufacturing method for each component, the aim of optimizing the robot was to reduce the weight of the moving machine parts, shorten cycle times, and minimize energy consumption. To achieve this, the amprove team explored suitable manufacturing processes and materials to achieve the ideal cost-benefit ratio.

To carry out this study and reach their goal, the amprove team required simulation software that would allow them to perform analyses and optimizations. In particular, they needed solutions that would perform structural optimization - primarily, topology optimization for the machine - and ensure component durability and manufacturability.

11 TO 4

COMPONENT
CONSOLIDATION

30KG ▼

MOVING MASS
REDUCTION

34% ▲

FASTER PRODUCTION



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One of the main challenges was retrofitting machines that had already been delivered. As such, the team had to ensure they could easily replace the old components with the new, optimized parts.

Our Solution

Altair's solutions empowered amprove to investigate various areas of the pick-and-place robot to find the best manufacturing method and optimize the components' structure. For the structural optimization, the team mainly used Altair® OptiStruct® to obtain reliable results. With it, the team could identify three different manufacturing processes and select two different materials for four components: selective laser melting (metal 3D printing process) for the Y-Z axis connection and the pneumatic console, selective laser sintering (plastic 3D printing process) for the grippers, and waterjet cutting for the Z-axis base plate.

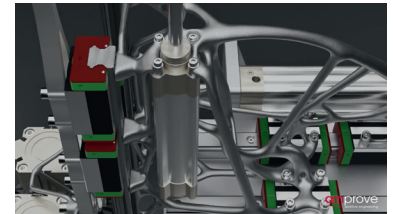
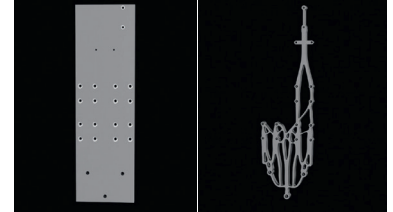
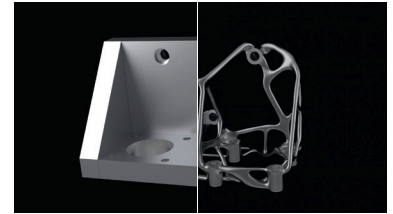
Optimizing the structure with Altair solutions created optimal component consolidation with a total of 11 components that could be combined to form four new components – thus saving 25 bolts via component integration. Despite this change, the most important project requirement was still met: the optimized components are plug-and-play, meaning they're interchangeable with the current components and can also be retrofitted on machines that have already been delivered. In addition, Altair solutions enabled the amprove team to reveal that two of the eight linear guides were not experiencing any load during operation and were thus unnecessary. Overall, Altair solutions allowed the amprove team to gain deep insights throughout the design and manufacturing process and achieve reliable results for even their most complex requirements.

Results

The results of the amprove robot retrofit speak for themselves, clearly demonstrating its impact. Through the reduction of components, the team successfully minimized assembly effort and simplified handling. Notably, the elimination of two linear guides and 25 screws resulted in reduced manufacturing and assembly costs. Additionally, by optimizing four of the robot's components, the overall moving mass was decreased by 29.8 kilograms, leading to a significant reduction in energy consumption during operation. As a result, production speed improved by 34% or energy costs were reduced by 52%.

In addition, due to enhanced processes with Altair solutions, amprove expects its customers to achieve a return on investments (ROI) within two years, attributed to reduced energy consumption resulting in substantial cost savings. Prior to adopting Altair solutions, amprove expressed dissatisfaction with their CAD, simulation, and optimization tools for structural optimization of complex assemblies. However, the success of recent studies has left amprove highly satisfied, acknowledging that the performance and manufacturability optimization capabilities offered by Altair's solutions are instrumental in attaining such results.

To learn more, please visit altair.com/industrial-machinery



TOP: The initial version of the pneumatic unit consisted of four different parts. The optimized pneumatic unit consists of only one part and the mass was reduced by over 90%. **MIDDLE:** The new version of the base plate of the Z axis was produced with waterjet cutting and has reduced the mass by over 80% compared to the old version. **BOTTOM:** The new machine design decreased the overall moving mass by 29.8 kilograms.