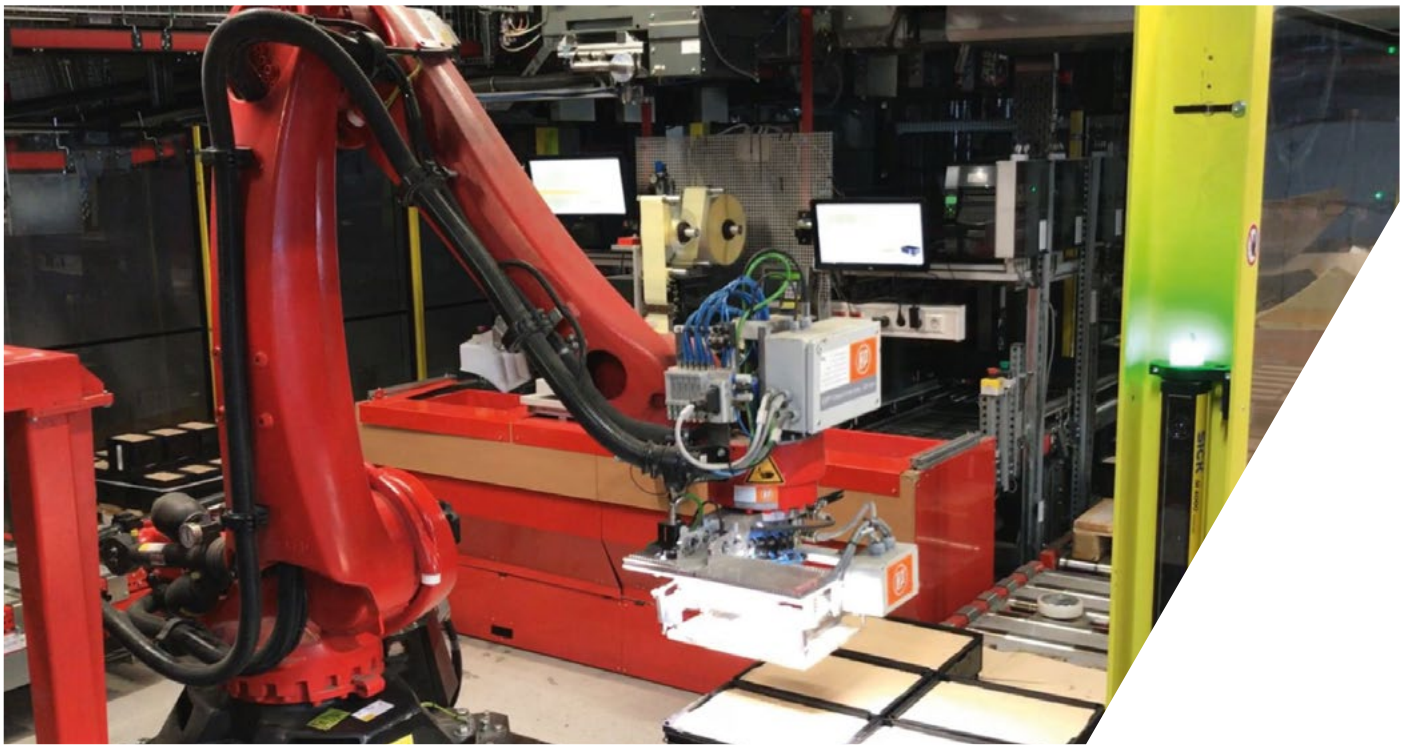
CASE STUDY



A FIRM GRIP ON LIGHTWEIGHT DESIGN

OPTIMIZED COMPONENTS AND MASSIVE SAVINGS THANKS TO ALTAIR INSPIRE™

About the Customer

Würth Industrie Service GmbH & Co. KG (WIS) is an independent subsidiary of the Würth Group, providing integrated logistics solutions for automated, efficient supply of production materials as well as auxiliary and operating materials. Focusing on manufacturing industrial customers' requirements for C-parts – small parts that are handled in bulk as their purchasing volume is low – WIS takes care of the overall support of more than 20,000 customers. The company offers individually tailored, logistical supply and service concepts such as scanner-supported rack systems and automated electronic ordering systems. With networked systems directly addressing the location of demand and consumption, WIS helps its customers to reduce procurement efforts, optimize processes, cut costs, and save time while simultaneously ensuring maximum supply security.

87% ▼
WEIGHT SAVINGS

94% ▼
REDUCED REPAIR COSTS

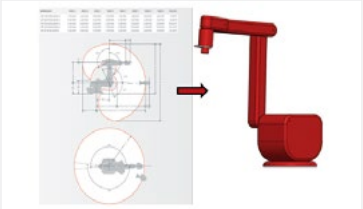
50% ▼
REDUCTION OF USED LED STRIPS

Their Challenge

In line with the company's ultimate goals including innovation, cost reduction, and process optimization, WIS wanted to explore how simulation can be used to improve its products. As achieving a lightweight design was one of its main goals, the company started a collaboration project with Altair to perform topology optimizations on components of its KUKA robots.

Within the logistics process, KUKA robots perform the task of sorting the Würth small load carriers (W-KLT® 2.0) onto pallets or trays for shipment to the customer. Depending on the size of the small load carrier (SLC), the robot automatically chooses the suitable gripper to pick up the load carrier. To recognize the goods and determine the size of the SLCs, the robot has a light panel equipped with a camera, cooling ribs, and LED strips for illumination. This aluminum light panel is mounted to the KUKA robot by a bracket above the light panel.

Frequently, during the automatic change of the robot's SLC grippers, the robots cause damage to the bracket of the light panel. Due to its high-quality components, the sensitive light panel is not only expensive to manufacture but entails high assembly costs and long delivery times in case of repair. Hence, a defect of the bracket leads to a time- and cost-intensive panel replacement. To avoid unnecessary downtimes of the robot and reduce the personnel and material costs, the brackets of the light panel had to be optimized.



Our Solution

First, the real-life scenario was digitally reproduced with an as-is analysis by determining the dimensions and masses of the individual components and examining the motion sequence. The KUKA robot was designed as a digital model using CAD software and then used as input for the unique simulation-driven design platform Altair Inspire™. The components were assigned to materials with corresponding dimensions, the motors and their motion sequences were added, and a multi-body simulation was conducted. Subsequently, a structural analysis of the 3D model was performed, giving insight into which forces and accelerations act on the single components and which stresses and deformations can occur.

Then, the calculated loads of the multi-body simulation were used as an input to create a topology-optimized bracket with an improved design, appropriate durability, and increased compatibility with the individual processes of the gripper change. The WIS team decided on the manufacturing processes milling and 3D printing and included the relevant manufacturing restrictions already in the topology optimization setup. By printing the optimized structure, the new bracket can be manufactured in real time, independent of the delivery times and prices of other service providers, thus effectively preventing downtimes. In addition to the original project, the team explored the LED plate and discovered that not all of the LED stripes are necessary for adequate lighting. As a result, the light panel could be reduced by half.

TOP: Loads of the multi-body simulation were used as an input to create the topology-optimized bracket.

MIDDLE: The original aluminum bracket vs. the 3D-printed, topology-optimized bracket.

BOTTOM: Altair Inspire was used to create a topology-optimized bracket with an improved design and appropriate durability.

Results

The WIS project succeeded in implementing lightweight design meeting the most demanding requirements and achieved excellent results. The final components experienced a weight reduction of 87%.

"As the lower mass protects the robots' mechanics and requires less energy, we were able to achieve significant cost savings in the production process and in daily use through effective use of resources," said René Pers, engineering & developing, Würth Industrie Service. "The optimized bracket also enabled us to drastically reduce repair and downtimes. Now, in the event of a defect, we only have to remove the affected part instead of replacing the entire assembly."

The optimized bracket and light panel save approximately 94% of the costs in relation to the current annual repair costs. The brackets's lightweight design thus leads not only to an improvement in product design, but also to an overall optimization – technologically, economically, and ecologically.