



JUST LIKE RIDING A BIKE

ALTAIR STARTUP PROGRAM IMPROVES 3D-PRINTED STRUCTURES AT URWAHN BIKES

About the Customer

Urwahn Engineering GmbH is a startup in the biking sector that's passionate about technology, quality, and design. Founded by a team of visionaries, it's headquartered in Magdeburg, Germany, where 20 technology pioneers design, develop, manufacture, and assemble user oriented bikes and e-bikes that inspire people with their streamlined designs and technical precision.

Following the principle of lean manufacturing, the company's philosophy is based on four pillars: design, functionality, processing, and sustainability. Urwahn uses advanced technologies like additive manufacturing to build its certified, copyrighted steel frame that combines organic design with high brand recognition and high functionality. Today, the company has two active production lines based in Germany, one of which deals with the frame's 3D printing and various additional parts like tubes, frame building, grinding techniques, and the coating levels up to the final assembly.

Their Challenge

While bikes must meet many requirements to pass globally recognized test and load case scenarios according to DIN ISO 4210 safety standards, they must also be as light as possible to reduce raw material usage and create the best possible user experience. In this aim, simulation has always played a key role at Urwahn, a team that strives to maximize functionality and performance by using state-of-the-art tools. In 2020, when supervising a bachelor thesis on the topology optimization and the redesign of an urban bike frame to reduce the wall thickness, the Urwahn engineers needed a tool that could optimize the steel frame's build structure. The primary goal was to reduce the frame weight by pushing areas like 3D-printed tubular and connecting elements to the limits while still guaranteeing product safety.

40% ▼

REDUCED TIME SPENT
ON TESTING

20% ▼

REDUCED WEIGHT

15% ▼

REDUCED WALL
THICKNESS



Try Altair® Inspire™ Today:
[Download Now](#)

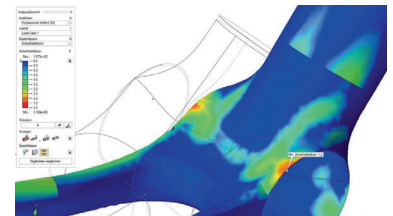
To do this, the Urwahn team couldn't rely on their existing simulation environment, since the process they needed to map was too complex and time-intensive. As such, Urwahn had to find a platform that could help the team identify structures they could improve, study the components in terms of the existing load cases prescribed by DIN ISO, perform the required simulations, and find an optimized lightweight solution in a timely manner.

Our Solution

Under the Altair Startup program, Urwahn received access to Altair® Inspire™, the powerful, easy-to-use topology optimization platform for innovative design and engineering throughout the entire product development process. Thanks to Inspire's intuitive user experience, the Urwahn team got started right away – without needing specialized training. To meet the DIN ISO 4210's safety requirements, they simulated five load cases on the steel frame structure (three dynamic tests with vertical, horizontal, and alternating forces, and two static tests of the frame and fork). In these scenarios, the Urwahn engineers studied the behavior of the single 3D-printed parts and explored the impact of the material distribution on the overall system behavior, aiming to minimize weight. Using the integrated topology optimization solver within Inspire enabled Urwahn to further push the material usage limit – thereby reducing weight and costs – while keeping stiffness and other boundary conditions on target.

Results

Thanks to Inspire, Urwahn studied the existing framework concept, detected limit values, and reduced the wall thicknesses significantly by testing different load case scenarios on the structure. As a result, the team lowered the steel frame's weight while maintaining its stiffness. In addition to reducing wall thickness by up to 15%, the Inspire results also implied that there is still room for improvement within safety regulation parameters. "Altair Inspire simplifies simulation and provides fast and accurate results," said Sebastian Meinecke, founder and managing director, Urwahn Engineering. "We quickly received the results we had hoped for to reduce the wall thickness while maintaining the stiffness of our steel frame. Without Inspire, we would not have been able to achieve these results in such a short time frame. The knowledge we gained with Inspire helped us to take a different approach and will definitely help us to push the design of the components closer to their limits."



TOP: The primary goal was to reduce the frame weight by pushing components like 3D-printed tubular and connecting elements to the limits while still guaranteeing product safety. **MIDDLE:** Simulating the load cases on the steel frame structure in Altair Inspire enabled Urwahn to meet the DIN ISO 4210 safety standards. **BOTTOM:** Initial results of the pedaling forces in Altair Inspire drive the improvements to meet safety regulation parameters.