

Industrial machinery and heavy equipment

Willingshofer

Industrial equipment manufacturer uses Mechatronics Concept Designer to get parquet floorboard production line right the first time

Products

NX, Solid Edge

Business challenges

Develop custom high-performance production line

Increase throughput and eliminate errors

Produce reliably predictable plant behavior

Reduce time needed for commissioning

Keys to success

Build and test a virtual prototype using Mechatronics Concept Designer

Use Solid Edge for design and development work

Use digitalization support from Siemens PLM Software partner ACAM

Results

Enabled right-the-first-time design, avoiding costly redesigns

Increased reliability of product behavior

Verified and optimized designs using a digital twin

Reduced time needed for commissioning

Verified plant performance prior to building hardware

Siemens PLM Software solution enables Willingshofer to use a digital twin to verify and optimize designs

From blacksmith to industrial equipment manufacturer

The primary business of Willingshofer GmbH is custom manufacturing of heavy machinery, including conveyor systems and industrial furnaces as well as hoisting and turning fixtures. Located in a remote valley in southeastern Austria, the ownermanaged family business was established as a blacksmith in 1908. During the 1980s, the company shifted its focus from agricultural to industrial customers. In addition to designing and manufacturing industrial equipment, Willingshofer also acts as a contract manufacturer.

For computer-aided design (CAD), Willingshofer engineers use Siemens PLM Software's Solid Edge® software. The easy to learn yet comprehensive 3D CAD software was deployed by the company in 2010. "Over time, it replaced a legacy software product that was well established but had decisive weaknesses," says Johannes Huber, design engineer at Willingshofer. "Models created and edited using Solid Edge



Parquet flooring comes in various material choices, surface structures and board sizes. Image: Weitzer Parkett.



For Weitzer Parkett, a parquet flooring manufacturer based in Weiz, Austria, Willingshofer created a fully automatic line producing the entire range of floorboards at an output of 360 pieces per minute.

are fully associative, and the software has far-reaching compatibilities with other systems."

This also proves an advantage when it comes to creating programs for the company's heterogeneous collection of numerically controlled (NC) machine tools. Production specialists in the manufacturing department use NX[™] software from Siemens for computer-aided manufacturing (CAM). They use NX CAM to create and simulate NC programs based on 2D and 3D data from Solid Edge and other CAD systems.

"Using NX CAM, our colleagues import

"Without Mechatronics Concept Designer, we would not have been able to deliver predictable results."

Siegfried Willingshofer Co-owner and Chief Executive Officer Willingshofer



Using Solid Edge, Willingshofer engineers created the digital twin of the floorboard production line.

models and drawings that come in all kinds of file formats from customers for contract manufacturing," says Huber. "Due to the software's built-in CAD capabilities, they don't need the engineering department to make the minor modifications that are often required during the manufacturing process."

Further, Willingshofer makes significant use of Mechatronics Concept Designer™ software, also a part of the NX suite, which has easy-to-use modeling and simulation capabilities that enable the user to quickly create and validate alternative kinematic design concepts early in the development cycle. They evaluated several material



"Since Mechatronics Concept Designer is part of NX, it comes with full CAD functionality so we could quickly make and try out modifications with the software."

Reinhard Poelzl Design Engineer Willingshofer

As part of the material handling installation, a flow of boards traveling at 20 to 100 meters per minute is split up.

transfer concepts involving pushers, a turnstile and lifting mechanisms before deciding to adopt a purely ballistic concept.

Unlike a model-based tool, Mechatronics Concept Designer allows you not only to see what the design looks like, but validate that it works.

From big and slow to fast and intricate

Willingshofer wins business with speed. In the owner-managed family business, decisions are made quickly, and manufacturing capabilities that start with milling individual parts means the company isn't dependent on external suppliers' lead times.

However, speed proved a challenge for the experienced mechanical engineering experts when parquet flooring manufacturer Weitzer Parkett sent an inquiry for a fully automated floorboard production line. The plant processes large panels of high-density fiberboard (HDF) and various types of wood. After priming, a saw cuts out boards in 15 different sizes ranging from 370 x 100 millimeters (mm) to 1,800 x 180 mm. These go through the varnishing booth and are subsequently structured before finally reaching a stacker.

The plant is designed to produce up to 360 boards per minute. "Between the processing stations, they travel at speeds of 20 to 100 meters per minute, depending on their size," says Huber. "Traditional manipulators or industrial robots are clearly too slow, so we had to rely on ballistics where the material flow needs to be redirected or split up."

In this scenario, gravitational and centrifugal forces considerably influence the boards' kinematics behavior.

At the given output rate, one out of 1,000 boards taking the wrong fork would statistically mean more than 20 mishaps per hour. This would not be acceptable.



Since the conveyor speed was too fast for traditional manipulators or industrial robots, Willingshofer engineers relied on ballistics, using the Mechatronics Concept Designer to verify and optimize the plant's design.

"To create common ground to discuss implementation details with customers, we are now using the Mechatronics Concept Designer as early as the proposal phase."

Siegfried Willingshofer Co-owner and Chief Executive Officer Willingshofer "Making the required calculations goes far beyond the capabilities of mental arithmetic and spreadsheets," says Reinhard Poelzl, design engineer at Willingshofer. "Consequently, we started looking for a tool to help us verify and optimize our designs for predictable results using a digital twin of the production line."

This proved a challenge as classical 2D material flow simulation software used in logistics is conceptually inadequate to solve the issues of fast three-dimensional material movements.

Physics-based simulation ensures predictable results

Visiting the booth of Siemens PLM Software solution partner ACAM Systemautomation GmbH (ACAM) at an automation trade show, Willingshofer saw a demonstration of Mechatronics Concept Designer. The software enables a multidisciplinary approach to machine design.

The Willingshofer design engineers used Mechatronics Concept Designer to import assemblies from Solid Edge. They omitted unnecessary details to simplify the models, then enriched the models with physical properties, such as joints, motion, collision behavior and friction coefficients for each component. "Creating digital twins of the machinery was easy using predefined values provided by a re-use library within the Mechatronics Concept Designer," says Poelzl. "For the transported wood as an inhomogeneous, natural material, however, we had to determine a range of friction coefficient values experimentally."

"Unlike other model-based tools, Mechatronics Concept Designer allows you not only to see what it looks like, but validate that it works before building a prototype," says Huber. "We actually dismissed designs that were not sufficiently tolerant to irregularities in upstream processes."

Fast results, high performance

Extensively testing the digital twins of critical parts of the floorboard production line, the engineers were able to verify the plant's design. "Since Mechatronics Concept Designer is part of NX, it comes with full CAD functionality so we could quickly make and try out modifications with the software," says Poelzl. "Feeding back successful design variations to Solid Edge with full associativity took a matter of seconds."

The software enabled Willingshofer to optimize the design over several iterations for maximum productivity and uptime without first building hardware.



As predicted by the digital twin in Mechatronics Concept Designer (left), up to 360 boards per minute are reliably separated.

Solutions/Services

NX www.siemens.com/nx Solid Edge www.siemens.com/solidedge Mechatronics Concept Designer www.siemens.com/mcd

Customer's primary business

Established in 1908, Willingshofer GmbH is a family business managed by fourth-generation owners. The company designs and manufactures custom industrial equipment, mainly for global customers in the iron and steel, electrical equipment and plant building industries. With about 80 employees, the company generates annual revenues of roughly €14 million. https://en.willingshofer.com

Customer location

Gasen Austria

Solution Provider Partner

ACAM Systemautomation GmbH www.acam.at "As we had verified all dimensions and transport speeds using the digital twin, our choice of components, such as motors and gears, was decisive very early in the development process," says Huber. "Ordering early enabled us to buy components at reasonable prices."

Prior to shipping the production line to the customer, the Willingshofer engineers performed extensive in-house tests. These revealed that all the predictions derived from testing the digital twin in the Mechatronics Concept Designer were so precise that only minor adjustments were required. This greatly reduced the time required for commissioning. It enabled the customer to easily achieve the goal of replacing the existing plant during a threeweek closure. For Willingshofer, the most significant benefit of using the Mechatronics Concept Designer is getting it right the first time. "Without Mechatronics Concept Designer, we would not have been able to deliver predictable results," says Siegfried Willingshofer, co-owner and chief executive officer (CEO). "This enabled both our customer and us to sleep better knowing there would be no surprises."

Willingshofer knows that predictable results are what customers want, but they have been hard to come by in the past, especially in custom projects. He concludes: "To create common ground to discuss implementation details with customers, we are now using the Mechatronics Concept Designer as early as the proposal phase."

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Siegfried Willingshofer Co-owner and Chief Executive Officer Willingshofer

Siemens PLM Software

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