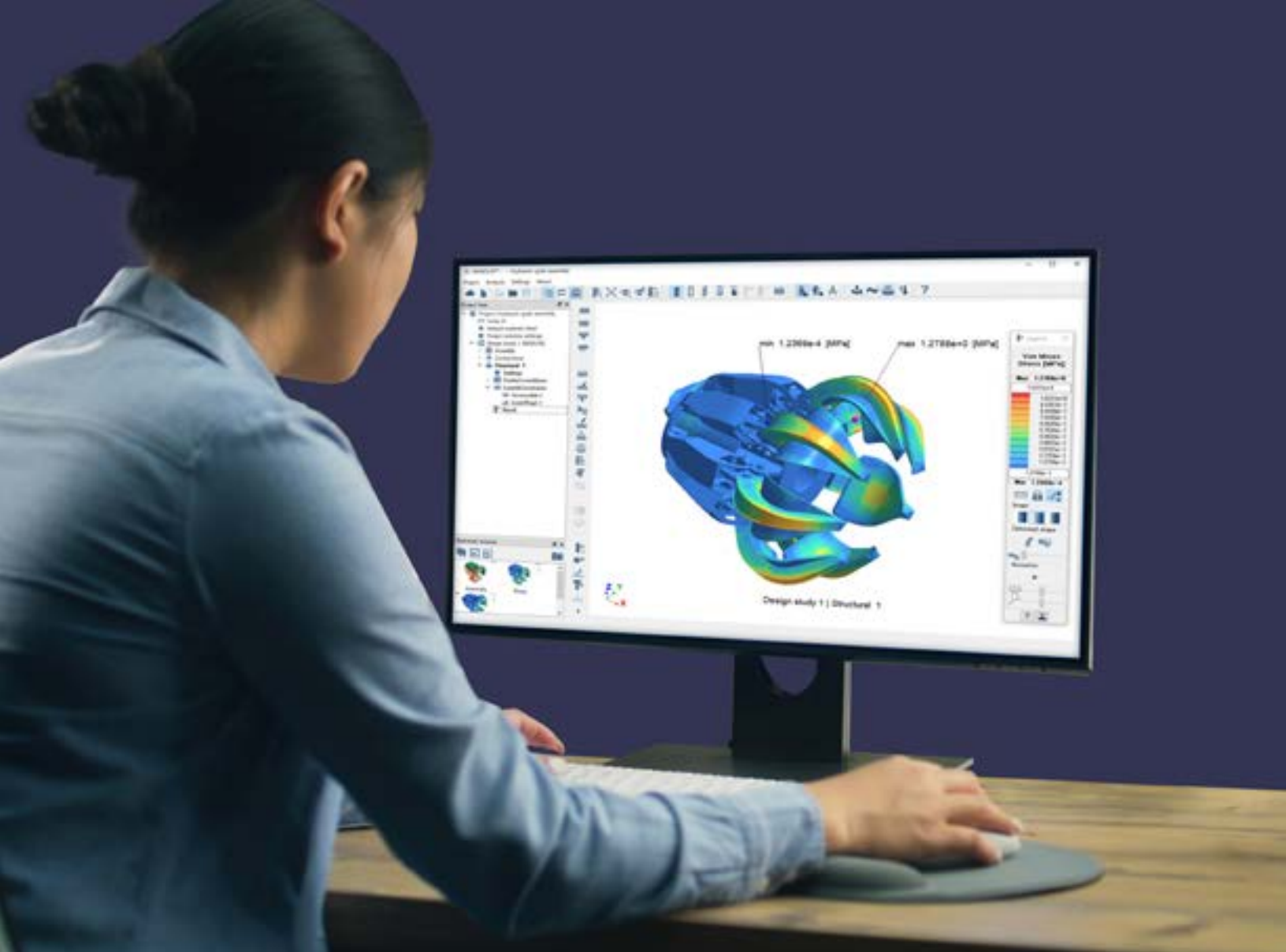




DIGITAL INDUSTRIES SOFTWARE

Seven engineering challenges solved with Simcenter Simsolid

siemens.com/software

SIEMENS



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Why Simcenter Simsolid?

Simcenter™ Simsolid™ is a game-changing simulation and structural analysis tool for designers and engineers. By eliminating geometry preparation and meshing, structural performance can be validated within minutes on fully featured CAD assemblies, saving time and reducing errors. Simcenter Simsolid allows teams to bring quality products to market faster and stay ahead of the competition.

Customers across industries, including automotive and transportation, industrial machinery, aerospace and defense, heavy equipment and construction and engineering, leverage Simcenter Simsolid to rapidly accelerate their CAE. Engineers can now eliminate the

meshing process and conduct load analyses in parallel with the design process to rapidly achieve optimal results. This enhances product quality and allows engineers to achieve critical results while maintaining high industry standards. Simcenter Simsolid is part of the Siemens Xcelerator business platform of software, hardware and services.

Explore these case studies to learn more about Simcenter Simsolid and how it can help you achieve your design and simulation goals.

Try Simcenter Simsolid today.

AUTOMOTIVE AND TRANSPORTATION

Doppelmayr

Increasing the component's fatigue life by a factor of four while reducing the seam weld's length by 3.5 meters

Product

Simcenter

Business challenges

Optimize bracket that failed a critical fatigue test to increase strength and fatigue life

Pass the critical fatigue test and meet high-safety standards

Realize high-precision components while considering material usage and manufacturing, time and budget

Keys to success

Create a full-scale simulation scenario

Improve stress distribution and relocate stress concentration outside the weld seams

Use Simcenter to generate the optimal design

Results

Increased the component's fatigue life by a factor of four

Reduced the seam weld's length by 3.5 meters

Passed the vibration test

Met safety targets while reducing the new design's manufacturing time and costs by 10 percent

Doppelmayr uses Simcenter for topology optimization to improve gondola lift station buildings

Background information

In modern passenger transport systems, flawless operation, comfort and safety are key engineering criteria for design. To guarantee these key performance indicators (KPIs), demanding fatigue tests are performed to ensure a component's performance and strength.

Today, advanced simulation methods can help to achieve an optimal design and ensure that components meet even the highest safety requirements. Doppelmayr Group (Doppelmayr), a manufacturer of ropeways and innovative transportation systems for ski areas and urban areas, used Siemens Digital Industries Software's solutions to analyze and redesign a structural component.

Using Simcenter™ Inspire™ software, Doppelmayr built a design that passed the



© Doppelmayr Seilbahnen GmbH

safety test, and optimized the gondola station to be lighter, safer and more durable than requested. This case study demonstrates how Siemens' solutions and support enabled Doppelmayr to develop with confidence.

Simcenter is part of the Siemens Xcelerator business platform of software, hardware and services.

About the customer

Doppelmayr is an international manufacturer of ropeways and innovative transportation systems for ski areas, urban transport, amusement parks and material handling systems. Doppelmayr was founded in 1893. By merging with the Swiss Garaventa AG in 2002, the Doppelmayr Group is now one of the world's leading ropeway manufacturers. As of 2020, the group has realized more than 15,100 installations in 96 countries worldwide.

Since 2017, it has used Siemens solutions like Simcenter Inspire for the topology optimization of its design parts to reduce

material usage and product weight, and to increase durability. More recently, Doppelmayr started using Simcenter Simsolid™ software to explore its designs and create structurally efficient concepts for large models and complex assemblies.

Their challenge

The Doppelmayr engineers had the task of optimizing a bracket of a Doppelmayr lift station building. Since the seam weld of this bracket had failed a critical fatigue test, it was necessary to improve the design of the component for increased strength and fatigue life of the connection.

The main challenge for the new design was to pass the critical fatigue test. This procedure tests the bracket by considering the maximum forces that can occur during ropeway operation, while measuring defined parameters like vibration and material strain. To meet the high-safety standards of the gondola transport system (the construction must withstand 100 Mio load cycles), Doppelmayr engineers had to find a solution that would enable them to realize high-precision components while

3.5 m ▼

less welding seam
per component

Fatigue-life
increased by factor

4 ▲



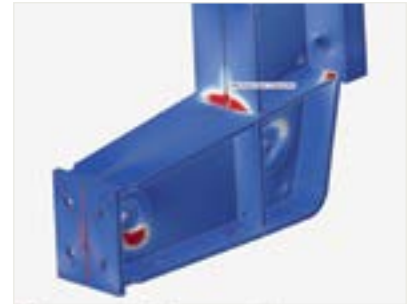
The experience we have gained by working with Siemens engineers will help us to continuously provide our customers with **safe and comfortable transport solutions.**"

Philipp Schneider

Head of the Structural Calculation Department
Doppelmayr



Doppelmayr was able to create an optimal design of a lift station building bracket using Simcenter Inspire.



The design with the overloaded area at the weld seams.



The optimized design with welded inserts using Inspire.

considering material usage and manufacturing, time and budget constraints.

From previous successful projects, the team has already gained a lot of experience with Siemens solutions. With Simcenter Inspire and the expertise of Siemens engineers, the Doppelmayr team was confident they would achieve a weight-reduced bracket with increased lifetime and endurance to pass the critical vibration test.

Our solution

Using test parameters, Doppelmayr engineers were able to create a full-scale simulation scenario. In the first step of the optimization process, the engineers specified the requirements of the new bracket design and generated the computer-aided design (CAD) model. As the initial tests revealed overstressing in one part, the aim was to redesign for better stress distribution and relocate the stress concentration outside the weld seams.

The original CAD data was then imported to Simcenter Inspire and the team defined both the external and internal clearance, design space and manufacturing method. After two iterations in Simcenter Inspire, the engineers were able to find the optimal design. The final design solution was a welded insert with a flame-cut profile and weld preparations. This ensured that the stress remained outside the weld seams, creating a better stress distribution and an increased lifetime.

Siemens enabled the Doppelmayr engineers to develop a multistep process, accurately predict the critical area of the first design that had failed the test and find the proper design modifications. Thanks to using Simcenter Inspire, Doppelmayr was able to generate an optimal design in a reasonable amount of time that met performance targets and was lighter than the original.

Solutions/Services

Simcenter Inspire

[siemens.com/
simcenter-inspire](https://www.siemens.com/simcenter-inspire)

Simcenter Simsolid

[siemens.com/
simcenter-simsolid](https://www.siemens.com/simcenter-simsolid)

Customer's primary business

Doppelmayr Group is an international manufacturer of ropeways and people movers for ski areas, urban transport, amusement parks and material handling systems.

www.doppelmayr.com/en

Customer location

Wolfurt, Vorarlberg
Austria

Results

Thanks to optimization using Simcenter Inspire, the engineers were able to increase the lifetime of the seam weld while reducing the length of each component's weld seam by 3.5 meters. As a result, the component passed the vibration test and the component's fatigue life was increased by factor four – from fatigue limit design to fatigue cut-off limit. In addition to meeting the safety targets, Doppelmayr also reduced manufacturing time and costs by approximately 10 percent for the new design. Long-term results

also include reduced maintenance costs due to the increased lifetime of the bracket.

"Thanks to working with Siemens, we are now able to accurately match our components to stringent quality and safety requirements," said Philipp Schneider, head of the structural calculation department of Doppelmayr. "The experience we have gained by working with Siemens engineers will help us to continuously provide our customers with safe and comfortable transport solutions."

AEROSPACE

INESPASA

Increasing agility of the decision-making process
by avoiding late design modifications

Product

Simcenter

Business challenges

Deliver maximum quality while complying with demanding standards, regulations, time constraints and budgets

Reduce time-consuming and expensive adjustments during production

Keys to success

Use Simcenter Simsolid to simulate and evaluate aero-structure concepts quickly and virtually

Apply Simcenter Inspire to optimize topology and multi-disciplinary simulations and system level analyses

Find the most suitable design rapidly and accurately

Results

Increased the agility of the decision-making process by avoiding late design modifications

Reduced development time significantly while accelerating innovation

Increased ROI

INESPASA uses Simcenter to accelerate the design of aero tooling structures

About the customer

INESPASA, an engineering company based in Spain, offers comprehensive solutions for turnkey projects in the aerospace and automotive sectors. With more than 35 years of experience in research and development (R&D) projects, tool design, manufacturing, precision machining and subassemblies, INESPASA has been working with major companies such as Airbus, Alestis, Boeing and Renault. The company's vision is to provide innovative, state-of-the-

art solutions and advanced technologies to key players in the aerospace and automotive industries and support them in their continual evolution. Today, INESPASA has two production plants in PE Aeropolis (Sevilla) and employs a highly qualified workforce of 150 people.

Their challenge

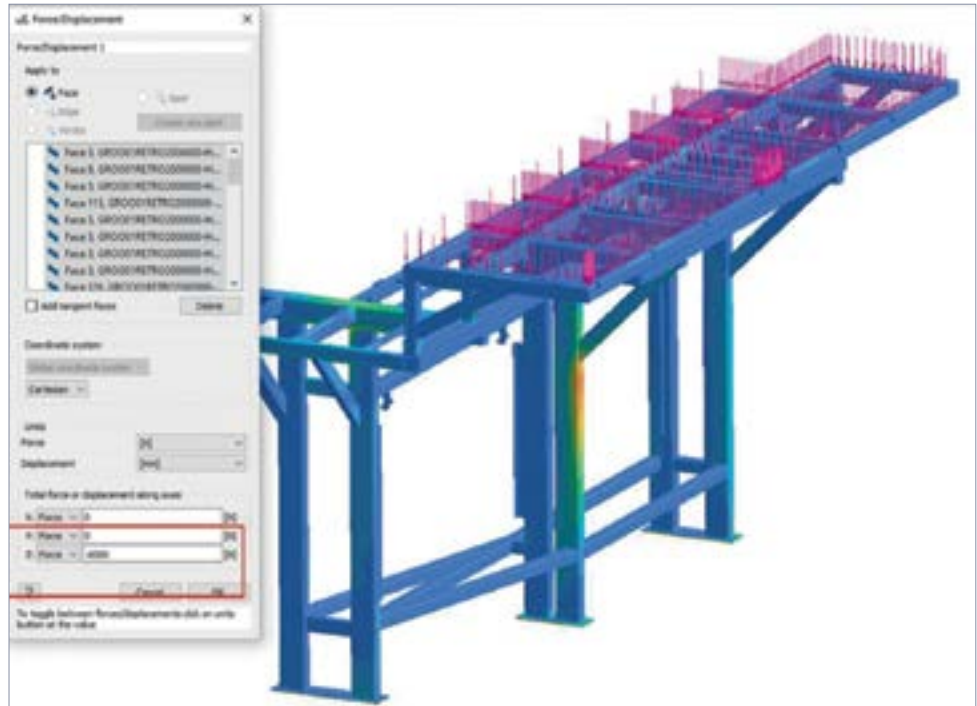
To be successful in a highly competitive market, aeronautical tooling companies such as INESPASA must deliver maximum quality for complex products and components, complying with highly demanding standards and regulations while meeting tight time constraints and limited budgets.



Results *(continued)*

Improved overall service conditions

Found the solution with the best weight-stiffness ratio



Using Simcenter SimSolid within Siemens' flexible license for structural simulation enabled the team to make fast decisions helping them to reduce the development time and improve their ROI.

Time has become a major challenge for many of INESPASA's projects focusing on the vertical integration of aerostructures, where adjustments are often required during the production of the first units, despite careful development. As developing and testing aircraft component

prototypes is time-consuming and expensive, INESPASA had to find new and faster ways – such as multiphysics simulation – to evaluate its aerostructure designs, identify problems before they occur and ensure the viability of the implemented solutions.



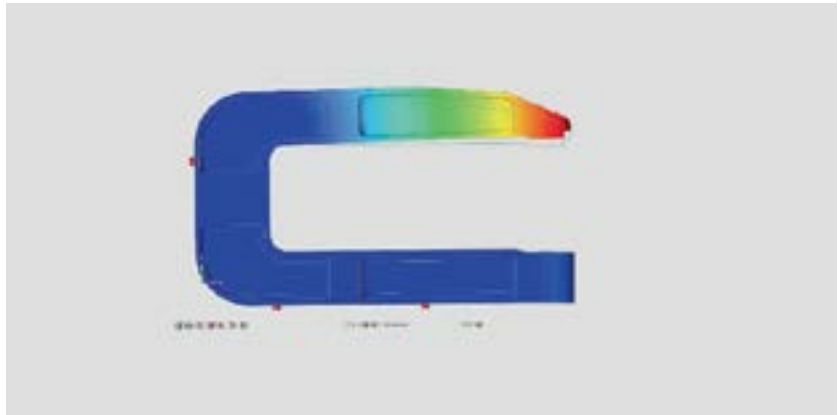
The speed and accuracy of using Simcenter Simsolid and the efficiency of the Simcenter suite allowed us to develop the most complex aerostructure assemblies with confidence and faster than ever before, increasing ROI.”

Cristóbal León
Head of R&D
INESPASA

Our solution

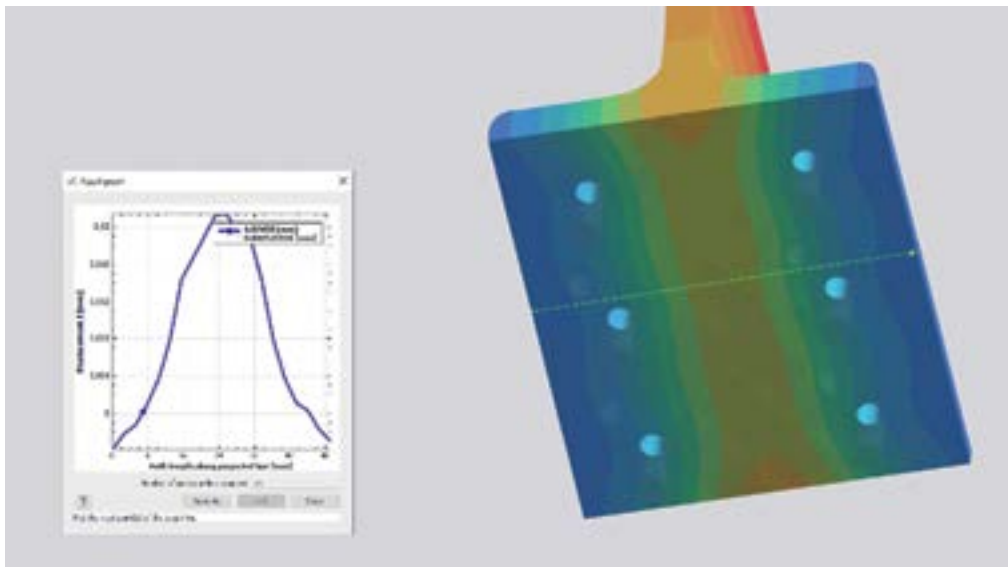
To achieve adequate stiffness values for the assembly instructions, the INESPASA team needed reliable results without resorting to the costly method of trial and error or time-consuming, repetitive finite element (FE) calculations. To evaluate the component designs, the INESPASA engineers considered various simulation tools and decided to utilize Siemens Digital Industries Software's solutions, in particular the fast structural analysis tool, Simcenter™ Simsolid™ software. Simcenter is part of the Siemens Xcelerator business platform of software, hardware and services.

With Simcenter Simsolid, the engineers were able to simulate their aerostructure concepts quickly and virtually evaluate them. Later, the team applied Simcenter Inspire™ software for topology optimization and for multidisciplinary simulations and system level analyses. The engineers performed multiphysics structural calculations to estimate the stiffness of the aeronautical structural elements to obtain a



Applying Simcenter Inspire for topology optimization INESPASA could predict and optimize the behavior of the principal component.

deformation level. Leveraging Simcenter Simsolid allowed them to evaluate various solutions rapidly and efficiently and with a high degree of accuracy to achieve the most suitable design. Thanks to the topology optimization in Simcenter Inspire, the team was able to predict the behavior of the main component and achieve an optimal design. Initially, without any detailed information, the engineers were able to evaluate the level and the critical paths of the stresses.



The stress and displacement results in Simcenter Simsolid are displayed as contour plots.

Solutions/Services

Simcenter Simsolid
[siemens.com/simcenter-simsolid](https://www.siemens.com/simcenter-simsolid)

Simcenter Inspire
[siemens.com/simcenter-inspire](https://www.siemens.com/simcenter-inspire)

Customer's primary business

INESPASA, an engineering company based in Spain, offers comprehensive solutions for turnkey projects in the aerospace and automotive sectors. With more than 35 years of experience in R&D projects, tool design, manufacturing, precision machining and subassemblies.

www.inespasa.com

Customer location

Sevilla
Spain

Results

Thanks to fast simulation results obtained with Siemens solutions, INESPASA addressed the challenge and found the solution with the best weight-stiffness ratio, providing an optimum usability of their aerostructure elements. Additionally, the engineers also improved the overall service conditions. Using the excellent computing capacities of Simcenter Simsolid enabled the company to increase the agility of their decision-making process by avoiding late design modifications and significantly reduced the development time while accelerating innovation. As a result, the component can be manufactured using

conventional chip removal techniques. Finally, the flexibility of Siemens' unique licensing system allowed the team to diversify its resources and extend the use of Siemens solutions beyond Simcenter Simsolid, significantly increasing the return-on-investment (ROI).

"The speed and accuracy of using Simcenter Simsolid and the efficiency of the Simcenter suite allowed us to develop the most complex aerostructure assemblies with confidence and faster than ever before, increasing ROI," says Cristóbal León, head of R&D at INESPASA.

HEAVY EQUIPMENT

Tadano

Accelerating crane development via Tadano's breakthrough in structural stress evaluation

Product

Simcenter

Business challenges

Reduce time and resource bottlenecks from the meshing process

Leverage time-consuming simplification techniques FEM requires

Overcome the gap between large-scale structures and highly localized stress areas

Keys to success

Use Simcenter Simsolid to eliminate the meshing process

Streamline design and development processes

Enhance product quality

Results

Made simulation processes 10 times faster

Eliminated the meshing process via a rapid and streamlined, analysis-driven workflow

Improved accuracy, precision and resolution

Captured localized stress concentrations

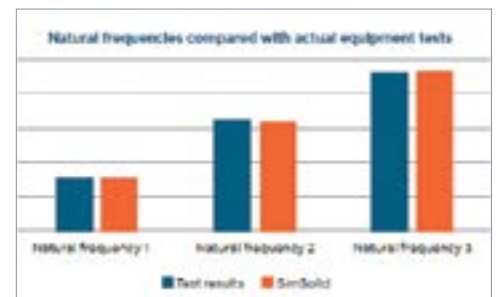
Simulated full assembly models without removing complex details

Reducing meshing workloads while ensuring accurate stress analysis with Simcenter Simsolid

Delivering optimal construction and infrastructure solutions

Tadano Ltd. is a construction machinery manufacturer with significant market share in cranes and aerial work platforms. Leveraging a broad product lineup and proven engineering expertise, Tadano delivers optimal solutions for construction and infrastructure projects worldwide. Tadano emphasizes safety, quality and efficiency in its manufacturing processes and consistently works to improve the strength, durability and safety of its products.

Recently, Tadano incorporated Siemens Digital Industries Software simulation technologies to streamline its design and development processes and further enhance product quality.

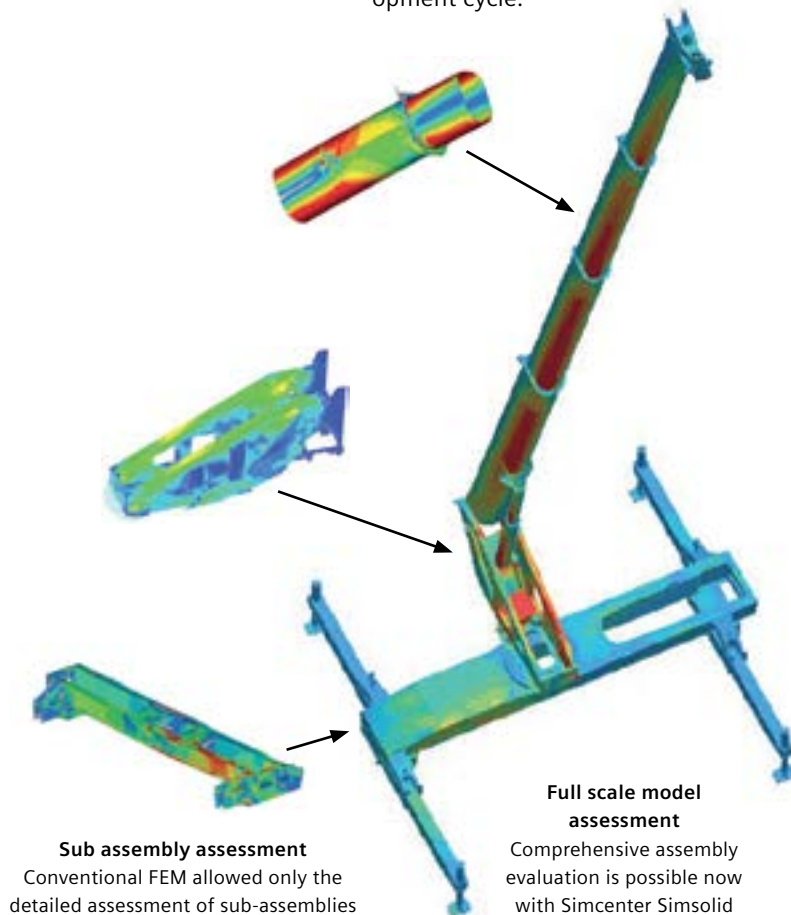


Simcenter Simsolid can represent the entire crane, making quantitative analysis possible.



Their challenge

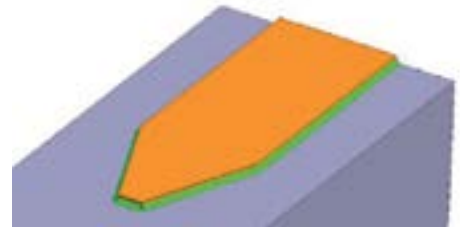
Tadano runs simulations to thoroughly evaluate and analyze product performance. However, before reaching that critical stage, they faced a significant bottleneck in the workflow: the meshing process. This single step alone demanded a significant investment of both time and resources, slowing down the overall development cycle.



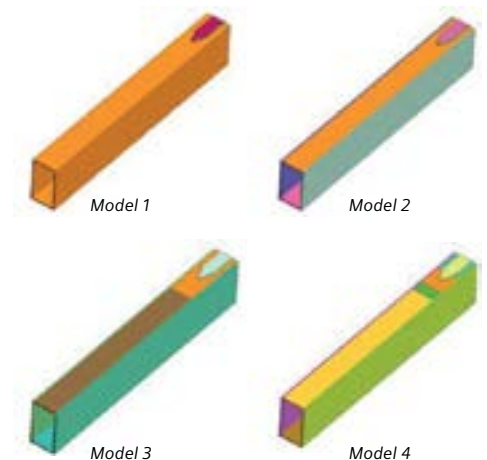
Tadano recognized the potential of using Simcenter™ Simsolid™ software to eliminate the meshing process entirely, transforming simulation from a time-intensive task into a rapid and streamlined,

analysis-driven workflow. This promise of efficiency and precision was a key factor in their decision to adopt Simcenter Simsolid, which is part of the Siemens Xcelerator business platform of software, hardware and services.

Additionally, Tadano's cranes can extend over 100 meters in length, but the critical stress concentration areas they need to evaluate are often localized within a few millimeters. This created a significant gap between the overall product scale and the mesh element size needed for accurate stress analysis.



A simple model of a cantilever beam was created to verify the effect of local stress due to model division.

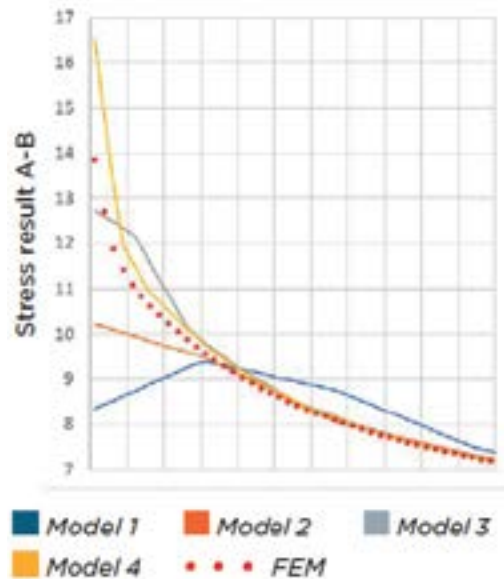
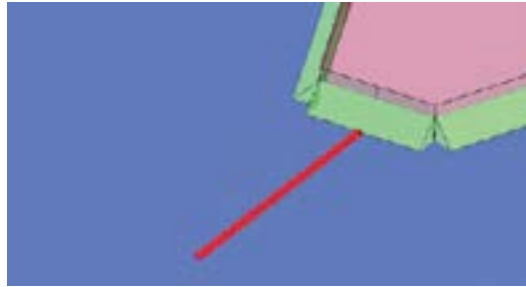


Test model with increasing number of geometry partitions, to refine the result visualization.

To overcome the gap between large-scale structures and highly localized stress areas, Tadano engineers had to rely on several simplification techniques within the conventional simulation process:

- Extracting and modeling only portions of the structure
- Applying customized boundary conditions
- Using shell elements instead of the solid elements
- Removing small but complex features like holes and components

Although these methods helped reduce model size and computational load, they inevitably introduced discrepancies from the physical product – a compromise the team had to accept. Over time, Tadano began to question whether conventional finite element methods (FEM) were truly suitable for analyzing large, highly complex structures.



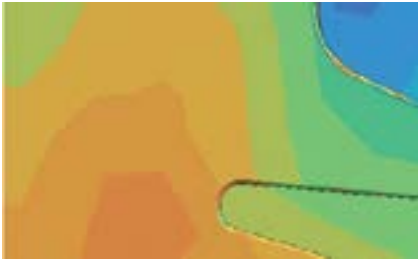
Stress result visualization improves with increasing refinement close to the stress concentration.



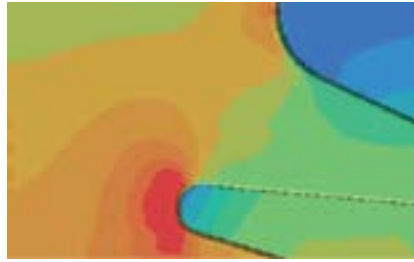
With Simcenter Simsolid, we can now perform simulations that were previously impossible, such as stress evaluation without simplification, or natural frequency estimation on full assembly models.”

Toshiyuki Miyajima

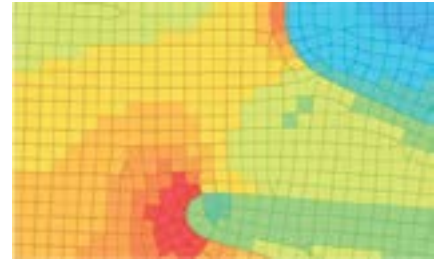
Assistant Manager, Advanced Technology Development
Tadano



Initial result visualization.



Result visualization after split strategy refinement.



FEM reference result visualization.

Our solution

The team turned to Simcenter Simsolid to simulate the entire product geometry without the need for these simplification techniques. However, in practice, a new challenge emerged: although full product geometry could now be modeled accurately, the stress distribution in critical, localized areas sometimes appeared unrealistic.

The engineering team sought to find a method to accurately represent stress concentrations in these critical areas using Simcenter Simsolid.

The solution came with the development of a targeted screening and refinement strategy. Tadano engineers identified areas

of high stress and isolated them into smaller, localized subparts. This approach prompted Simcenter Simsolid to automatically generate a finer response mesh in those regions. The “response mesh” is the visualization mesh that Simcenter Simsolid automatically generates to display contour plot results.

The result was a significant improvement in accuracy. Stress distributions in critical areas became noticeably clearer and more precise, enabling confident design decisions without the compromises of traditional methods. Leveraging Simcenter Simsolid bridged this gap, enabling accurate stress evaluation without the time-consuming complexities of conventional meshing.



We are also satisfied with the solution's accuracy. The stress values calculated internally by Simcenter Simsolid are highly reliable.”

Toshiyuki Miyajima

Assistant Manager, Advanced Technology Development
Tadano

Solutions/Services

Simcenter Simsolid
[siemens.com/simcenter-simsolid](https://www.siemens.com/simcenter-simsolid)

Customer's primary business

Tadano Ltd. is the main and largest Japan-based manufacturer of cranes and aerial work platforms, and is considered one of the biggest crane manufacturers in the world..

[tadano.com/index.html](https://www.tadano.com/index.html)

Customer location

Takamatsu
Japan

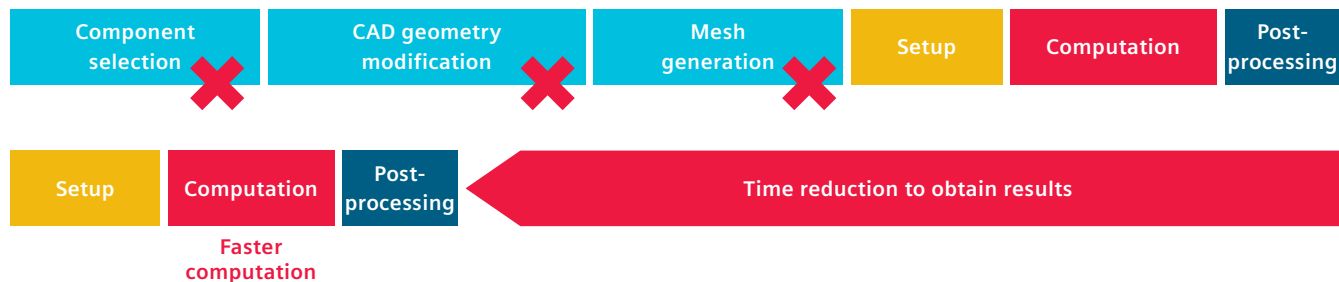
Results

By subdividing critical areas into smaller components, Tadano engineers were able to prompt Simcenter Simsolid to automatically generate a finer response mesh in regions with stress concentrations, significantly enhancing the resolution and accuracy of the results.

"With Simcenter Simsolid, we can now perform simulations that were previously impossible, such as stress evaluation without simplification, or natural frequency estimation on full assembly models," says Toshiyuki Miyajima, assistant manager of the advanced technology development department. "We are also satisfied with the solution's accuracy. The stress values calculated internally by Simcenter Simsolid are highly reliable."

In Simcenter Simsolid, response mesh generation is governed by a range of computational factors beyond direct user specification, ensuring that refinement adapts dynamically to the unique characteristics of each case rather than following a uniform scheme.

Despite this, the resulting stress distribution results in high-concentration areas closely aligned with those obtained through traditional FEM methods, validating the approach and increasing confidence in the simulation results. Using Simcenter Simsolid to assess complete crane structures allowed the Tadano team to make the simulation process ten times faster.



Efficiency gain with Simcenter Simsolid as alternative to FEM.

AUTOMOTIVE AND TRANSPORTATION

Dumarey

Using flexible units licensing system to gain access to more than 150 Siemens and partner products

Product

Simcenter

Business challenges

Make informed design decisions early based on simulation results

Avoid costly design iterations and critical delays throughout development

Adopt complete solution that could handle large, complex assemblies

Keys to success

Use flexible units licensing system to gain access to a wide range of Siemens applications

Use Simcenter Simsolid to build model and conduct analysis in minutes

Use Simcenter Simsolid to simplify contact generation and setting of boundary conditions

Results

Used flexible units licensing to access more than 150 Siemens and partner products

Slashed development time from four weeks to one, reducing development time by 75 percent

Optimized development process, enhancing competitiveness

Dumarey uses Simcenter Simsolid meshless structural analysis to reduce development time by 75 percent

Seeking to reduce complexity

Dumarey, committed to continually enhancing their design processes and strengthening the capabilities of traditional finite element modelling (FEM), proactively explored faster but equally accurate simulation methods. Their challenge was the complexity of creating models and analysis, often taking several weeks, which risked costly iterations and time delays. Partnering with Siemens, Dumarey adopted Simcenter™ Simsolid™ software, a

meshless structural analysis tool that streamlines modeling by eliminating geometry preparation and meshing. Simcenter is part of the Siemens Xcelerator business platform of software, hardware and services.

This solution allowed Dumarey to quickly analyze complex assemblies and explore multiple design variants. The impact was significant: development time was reduced by 75 percent, from four weeks to one. The units licensing system further supported Dumarey's needs by offering flexible access to a broad suite of software tools, enhancing their engineering efficiency and maintaining a competitive advantage in a fast-paced market.



“Now we can efficiently and accurately solve complex problems in a few days, compared to the weeks it would take with traditional methods. And better still, the tool is easy to learn and has a very intuitive interface.”

Mario Saracino
Analysis Technical Leader,
Structural Analysis
Dumarey

About the customer

Dumarey, formerly General Motors Global Propulsion Systems, is an engineering company with a portfolio ranging from internal combustion engine (ICE) development to micromobility via control units, kinetic energy recovery systems, transmissions and e-drives. Driven by its mission to revolutionize propulsion and control systems engineering, the company's development team strives to achieve a faster, more efficient design and release process for prototypes that reduce lead time while improving quality. To accomplish this, Dumarey's virtual engineering and noise, vibration and harshness (NVH) analysis team deploys Siemens' best-in-class technology solutions to optimize their processes and perform development tasks from design simulation to validation.

Their challenge

It's pivotal for the Dumarey team to be able to make informed design decisions early based on fast, accurate simulation results. These simulations help them avoid costly design iterations and critical time delays throughout the development process.

In the company's standard development process, they start by creating a complex finite element model (FEM), mapping the components and relevant physics. Because of the complexity of these models and the fact that all boundary conditions and contact between parts must be considered,

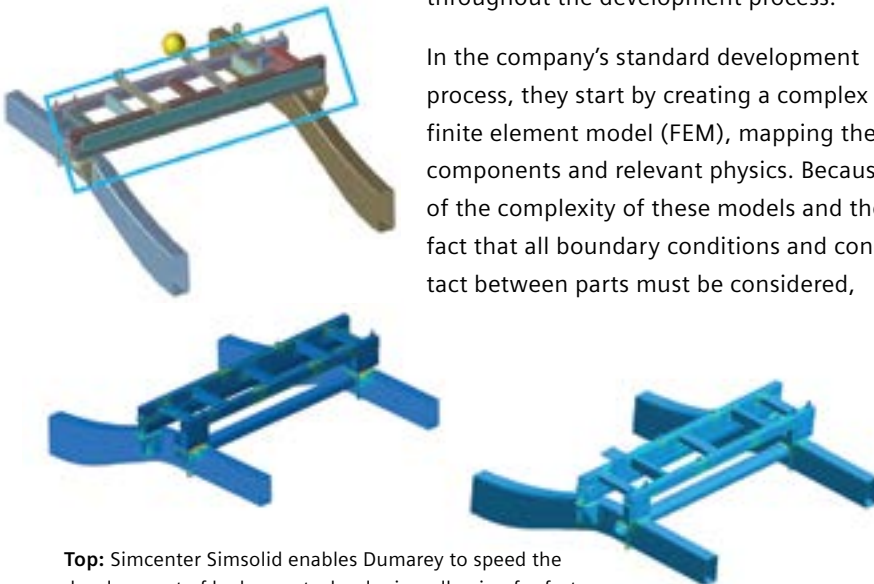
this creation is a lengthy process that can take up to several weeks. In addition, long compute times or solver convergence issues can cause costly delays. While the analysis response time could be shortened by simplifying models of complex assemblies, simplification can lead to unfavorable design decisions based on incomplete assumptions.

Since time is everything in today's competitive landscape, Dumarey's engineering team needed a comprehensive solution that could handle large, complex assemblies while providing timely, accurate results. Having previously collaborated on projects, the team chose Siemens to get the job done.

Our solution

Dumarey partnered with Siemens experts to accelerate their development process. The company benefitted from the flexible units licensing system, which gave them unlimited access to a wide range of Siemens applications, including its structural analysis tool, Simcenter Simsolid.

Although Dumarey often faced typical issues within their traditional FEM approach, Simcenter Simsolid offered the team a new approach: the power of meshless software. By eliminating geometry preparation and meshing – the team's two most time-consuming and expertise-intensive tasks – Simcenter Simsolid empowered Dumarey's engineers to build models and perform structural analyses on fully featured computer-aided design (CAD) assemblies within minutes. Simcenter Simsolid also allowed them to simplify contact generation and the setting of boundary conditions, further reducing their modeling time.



Top: Simcenter Simsolid enables Dumarey to speed the development of hydrogen technologies, allowing for fast model building and multiple design iterations. **Bottom:** Using Simcenter Simsolid for structural analysis, Dumarey obtained accurate results much faster than what's possible with traditional FEA approaches.

Solutions/Services

Simcenter Simsolid

www.siemens.com/simcenter-simsolid

Units

www.siemens.com/units

Customer's primary business

Dumarey leads the hardware engineering of innovative propulsion systems, based on the unique combined expertise of developing, producing and integrating proven technologies, systems and processes towards turnkey solutions.

www.dumarey.com

Customer location

Turin

Italy

Results

Overall, Simcenter Simsolid empowered Dumarey to analyze complex parts and large assemblies at unprecedented speed, explore multiple design variants and obtain the accurate results they need to make informed design decisions. Using Simcenter Simsolid helped them streamline the model creation and analysis processes. Significantly, Dumarey slashed development time from four weeks to just one thanks to Siemens solutions, reducing their development time by 75 percent.

In addition to time savings, Dumarey benefited from the possibility of using additional Siemens products via the units system. Units allow the company to access more than 150 Siemens and partner products and run software from any location

and within any deployment method. "No other tool I know of compares to the speed and accuracy of Simcenter Simsolid for structural analysis," says Mario Saracino, analysis technical leader, structural analysis, Dumarey. "Thanks to its lightning-quick design iterations, we can explore multiple alternatives in parallel with minimal additional effort. Now we can efficiently and accurately solve complex problems in a few days, compared to the weeks it would take with traditional methods. And better still, the tool is easy to learn and has a very intuitive interface."

Simcenter Simsolid and the units licensing system helped Dumarey optimize their development process, allowing them to stay ahead of the competition in a global market where speed and accuracy are the ultimate keys to competitive advantage.



No other tool I know of compares to the **speed and accuracy of Simcenter Simsolid for structural analysis.** Thanks to its lightning-quick design iterations, we can explore multiple alternatives in parallel with minimal additional effort."

Mario Saracino

Analysis Technical Leader, Structural Analysis

Dumarey

INDUSTRIAL MACHINERY

Faraone

Decreasing weight by 18 percent, increasing stiffness by 5 percent and reducing the entire design cycle by 40 percent

Product

Simcenter

Business challenges

Develop a new NINFA model

Reduce the NINFA125's weight while adhering to the necessary safety measures by optimizing the load distribution

Keys to success

Use Simcenter Inspire for topology optimization with an emphasis on reducing weight and improving stiffness

Leverage Simcenter Simsolid for quick and accurate validation

Results

Decreased weight by 18 percent

Increased stiffness by 5 percent

Reduced the entire design cycle by 40 percent, realizing three validation analyses in under 90 minutes

Shortened the time for studying and redefining the design to less than 30 minutes

Faraone uses Simcenter to cut costs and design times for large-scale, complex lightweight structures

About the customer

Located in Tortoreto, Italy, Faraone manufactures high-end lightweight structures and glass systems, offering half a century of experience and innovation in the world of transparent architecture. Specialized in developing and manufacturing glass staircases, facades or canopies, Faraone has a proven track record of realizing tailored architecture. As Italy's market leader for glass balustrades, Faraone was one of the first companies in Italy to adopt the point-fixed glass system, which allows architectural glass to be drilled and directly fixed on its bearing structure using mechanical connections and support structures.

Their challenge

To develop a new model of Faraone's best-known product, NINFA, the engineering team had to start from zero. NINFA is an aluminum profile with a U-shaped channel that clamps on the structural glass panel. The system is fully adjustable for lateral installation and allows for a frameless glass balustrade that offers a superior view of the panorama.

The main challenge was to reduce the weight of the NINFA model, NINFA125, using topology optimization while simultaneously ensuring the necessary safety measures by optimizing the load distribution. NINFA125 model can hold a glass thickness of 17.52 millimeters (mm) and 21.52 mm. NINFA125 measures 85 mm by 125 mm. To solve the engineering challenges in the design of these architectural components, which must meet several safety



“The adoption of Simcenter Inspire and Simcenter Simsolid in our workflow has been transformational. We could reduce the entire design cycle by 40 percent and realize three validation analyses in less than 90 minutes, allowing us to design lighter and safer support structures.”

Gabriele Romagnoli
Head of Structural
Engineering
Faraone

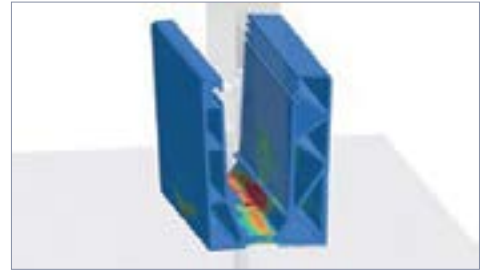
requirements and standards, Faraone used the most advanced simulation technologies.

Our solution

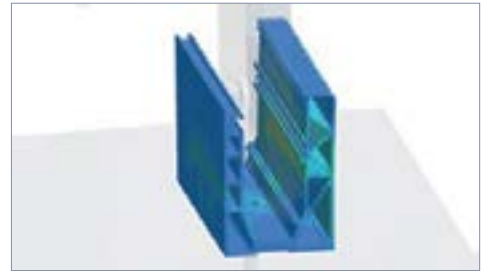
For NINFA125, the team set up an integrated workflow starting with concept design and optimization in Simcenter™ Inspire™ software. Simcenter is part of the Siemens Xcelerator business platform of software, hardware and services. The engineers first defined the available design space with Simcenter Inspire by creating a simple U-section. This enabled them to run a topology optimization on the shape of the aluminum profile, with emphasis on weight reduction and stiffness improvement. Constraints included free spaces for the glass panel and glass fasteners, as well as for floor mounting.

With these optimization results, Simcenter Simsolid™ software was employed for fast and accurate validation in a second step. The geometry and refinement of the profile were analyzed, and the results of the initial analysis were used as input for a stress analysis of the optimized profile.

After implementing and reanalyzing the results, the team found the optimal stress distribution while preserving the integrity of the glass panel. Faraone was then able to transfer the 3D computer-aided design (CAD) model directly into Simcenter



First validation analysis; Subsequent to the optimization, NINFA125 V1 was validated using Siemens Simcenter Simsolid



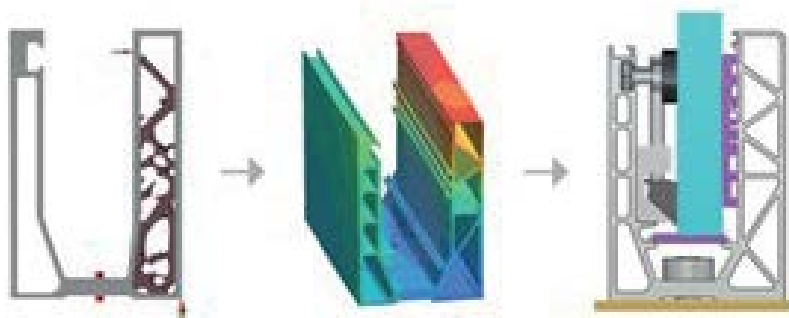
Third validation analysis; The redesigned final version of NINFA125 profile was again validated using Simcenter Simsolid, providing fast and accurate results.

Simsolid without having to simplify the geometry for the subsequent nonlinear analysis.

The deflection analysis of the profile resulted in a maximum displacement of 3.2 mm under the serviceability loading, which corresponded to the allowable displacement of 3.5 mm. Lastly, the final prototype was converted into high-fidelity finite element method (FEM) models for a final validation analysis regarding stress, displacement, reaction forces and buckling.

Results

Thanks to an integrated workflow that includes topology optimization and nonlinear simulation, NINFA125 is now up to 18 percent lighter than previous aluminum profiles with an increased stiffness of 5 percent. In addition, using Simcenter Simsolid enabled Faraone to reduce the time needed for studying and redefining the design of complex glass structures to less than 30 minutes.



Optimization results, interpretation of the results and validation analysis.

Solutions/Services

Simcenter Inspire

siemens.com/simcenter-inspire

Simcenter Simsolid

siemens.com/simcenter-simsolid

Customer's primary business

Faraone manufactures high-end, lightweight structures and glass systems with 50 years of transparent architecture experience and innovation. Faraone was among the first companies in Italy to adopt the point-fixed glass system, allowing architectural glass to be drilled and directly fixed on its bearing structure using mechanical connections and support structures.

faraone.it/en/

Customer location

Tortoreto
Italy

"The adoption of Simcenter Inspire and Simcenter Simsolid in our workflow has been transformational," says Gabriele Romagnoli, head of structural engineering at Faraone. "We could reduce the entire design cycle by 40 percent and realize three validation analyses in less than 90 minutes, allowing us to design lighter and safer support structures. Thanks to

Siemens solutions, we could quickly find the optimal design layout for our NINFA models with Simcenter Inspire and then verify the rationalized geometry with Simcenter Simsolid. In addition, we can leverage Simcenter Simsolid for the nonlinear analyses for our complex structural assembly of more than 1,000 parts."



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Gabriele Romagnoli

Head of Structural Engineering
Faraone

CONSTRUCTION

RINGER

Increasing scaffolding levels without adding weight, going from two stories to seven

Product

Simcenter

Business challenges

Meet the industry's latest safety standards

Ensure accurate dimensioning to avoid project delays and increased costs

Optimize maximum vertical load while allowing clearance for building protrusions

Extend scaffolding levels without increasing weight

Keys to success

Use Simcenter Simsolid to perform structural analyses without relying on external experts

Perform load analyses in parallel with the design process and attain optimal results

Understand how to modify the design to meet Eurocode requirements

Results

Increased scaffolding levels without adding weight, going from two stories to seven

Saved time while reducing physical prototypes

RINGER uses Simcenter to reduce scaffolding design cycle time and costs

About the customer

Headquartered in Regau, Austria, RINGER is a leading manufacturer of scaffolding and formwork systems with offices throughout Europe. For more than 80 years, RINGER has been supplying high-quality products to its customers worldwide. The company's product range spans facade scaffolding, fall protection systems, transport containers and formwork systems for modern concrete buildings and frame structures, such as multistory buildings. Committed to quality and reliability, RINGER designs scaffolding that meets stringent material and safety requirements. To fulfill the company's exacting quality standards, RINGER has

implemented Siemens Digital Industries Software's Simcenter™ software, which is a leading design and simulation technology, in its product development process. Simcenter is part of the Siemens Xcelerator business platform of software, hardware and services.

Their challenge

Used mainly on construction sites, scaffolding systems must be constantly monitored and tested to meet the industry's latest safety standards. RINGER knows ensuring product safety begins in design development; finding the correct dimensioning early plays a crucial role in creating quality designs. Ensuring accurate dimensioning is essential, since unprecise dimensions can cause project delays and increase development and material costs.



Results *(continued)*

Decreased mass and cost by streamlining material use

Ran simulations and achieved results without needing in-depth FEM knowledge

In a new project, RINGER engineers needed to design a new component of a facade scaffolding system called a cornice frame. Cornice frames are used when parts of a building extend into the scaffolding area, requiring the scaffolding to bypass these protrusions. Inherent in their design, cornice frames are less vertically load bearing than standard scaffolding frames. The challenge lies in optimizing the maximum vertical load from the scaffolding above while simultaneously allowing sufficient clearance for building protrusions.

RINGER's main goal was to extend the number of scaffolding levels above the cornice frame without increasing the frame's weight. Until recently, RINGER's approach to finding the right dimensioning for new products involved initial design followed by an evaluation by a structural engineering expert. Since this process involved using traditional finite element

analysis (FEA), this meant RINGER often needed to wait up to several weeks before receiving the feedback needed to perform revisions. Furthermore, although the FEA-centric approach was usually able to reliably identify and prevent under-dimensioned components, it often missed over-dimensioned components, which led to unnecessary material use, higher costs and delays.

Since RINGER produces its products in high volumes, reducing these products' mass and costs were vital. To address these challenges and foster an efficient design process, RINGER sought a new simulation tool that would allow them to calculate structural loads early in development. Ideally, the tool would also provide feedback on product behavior as designers adjusted models. Lastly, the tool needed to be easy to use and implement.



Thanks to the fast, accurate results provided by using Simcenter Simsolid, we drastically reduced our development time and the number of physical prototypes needed. As a result of this much-accelerated design process, **we significantly lowered our development costs while maintaining the high standards RINGER is known for."**

Hermann Pohn

Head of Product Management and Product Development
RINGER

Our solution

When RINGER learned about the capabilities of Siemens structural analysis software Simcenter Simsolid™ software – part of the Simcenter design and simulation platform – their development team started using the tool extensively. Simcenter Simsolid is easy to use and empowered RINGER to perform structural analyses without having to rely on external experts. One of the first projects was the dimensioning of a steel cornice frame measuring 0.65 meters by 2 meters, featuring a double balustrade. The project had to comply with two Eurocodes (EN 12810 and EN 12811), which are standardized rules for the structural and geotechnical design for scaffolding throughout Europe.

Using Simcenter Simsolid, the RINGER designers were able to perform the load analyses in parallel with the design process and quickly and reliably attain optimal results. To perform a structural (linear) analysis of the design, the project team assumed various load combinations (von Mises criteria) in the model. According to the results of the stress analysis, the



Using the results of the stress analysis, RINGER gained a clear understanding of how to modify the design to meet requirements.



The models with more than two floors on top showed a large area with von Mises stresses exceeding the steel's yield strength.

models with more than two floors on top showed a large area with von Mises stresses exceeding the steel's yield strength. As a result, the team gained a clear understanding of how to modify the design to meet Eurocode requirements for structures used on upper floors.

Results

By conducting load analyses in parallel with the design process with Simcenter Simsolid, RINGER's project engineers saved a significant amount of time while slashing the number of physical prototypes needed to achieve production maturity. Furthermore, since Simcenter Simsolid reliably identified over-dimensioned components, RINGER was able to streamline material usage to achieve substantial mass

Solutions/Services

Simcenter Simsolid

[siemens.com/simcenter-simsolid](https://www.siemens.com/simcenter-simsolid)

Simcenter Inspire

[siemens.com/simcenter-inspire](https://www.siemens.com/simcenter-inspire)

Customer's primary business

RINGER is a leading scaffolding and formwork systems manufacturer with offices throughout Europe. For over 80 years, RINGER has been supplying high-quality products to its customers worldwide, with products ranging from facade scaffolding, fall protection systems, transport containers and formwork systems for modern concrete buildings and frame structures.

ringer.cc/en/

Customer location

Regau

Austria

and cost savings. The tool enabled the project team to achieve their goal of increasing the number of scaffolding levels while not adding weight to the system.

Now, instead of two stories, seven stories are possible. Since Simcenter Simsolid was easy to use, RINGER's engineers were empowered to run simulations and achieve reliable results without needing in-depth knowledge of finite element modeling (FEM). This democratization of simulation, which drove substantial savings in time, costs and material usage, would not have been possible without Siemens software.

"Thanks to the fast, accurate results provided by using Simcenter Simsolid, we drastically reduced our development time and the number of physical prototypes

needed," Hermann Pohn, head of product management and product development at RINGER. "As a result of this much-accelerated design process, we significantly lowered our development costs while maintaining the high standards RINGER is known for."

For RINGER, using Simcenter simulation-driven design software has become invaluable, enabling all its engineers to quickly achieve optimal results while maintaining the high standards required in their industry. RINGER also aims to leverage other Siemens solutions within the Simcenter platform, such as Simcenter Inspire™ software for topology optimization, to further meet their organizational goals and satisfy their customers.

ARCHITECTURAL, URBAN PLANNING AND ENGINEERING

Skidmore, Owings & Merrill

Importing CAD models and generating results five times faster than traditional FEA methods

Product

Simcenter

Business challenges

Use a multi-hazard resilience approach to address structural problems from natural disasters

Requires additional external peer reviews, which significantly lengthen a building project

Overcome time constraints to meet client deadlines

Keys to success

Leverage Simcenter Simsolid to act directly on imported CAD models without needing to simplify geometry

Eliminate CAD geometry simplification and complex mesh creation

Results

Imported CAD models and generated results five times faster than traditional FEA methods

Completed jobs that typically took two weeks in two days

Accelerated workflows by visualizing stress, strain and deformation with detailed contours

SOM uses Simcenter Simsolid to slash project timelines, completing jobs that typically took two weeks in two days

About the customer

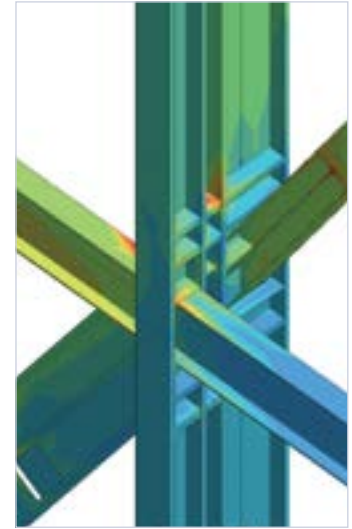
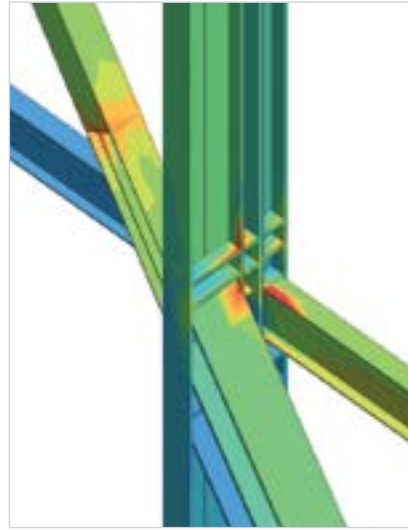
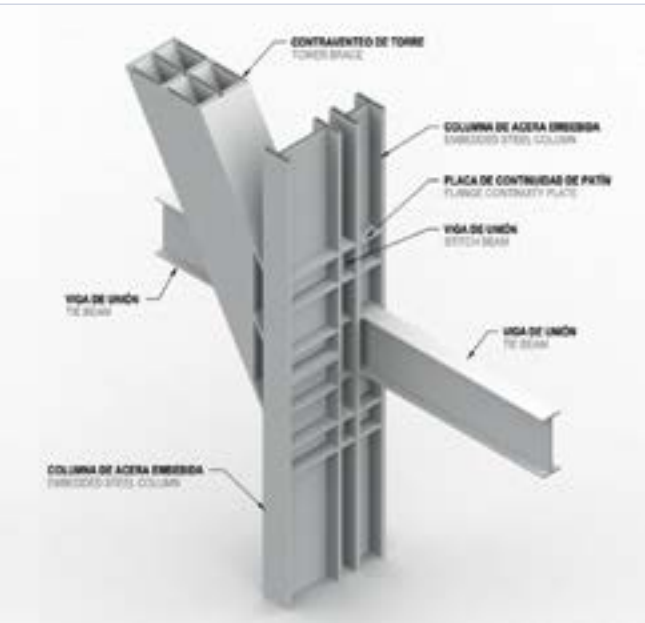
Skidmore, Owings & Merrill (SOM) is a renowned architectural and design firm known for its iconic and innovative buildings around the globe. Its reputation as a

global leader in sustainable architecture and design, as shown by its many projects, leads the company to design and consult on some of the world's most challenging structural design projects.

Their challenge

Tall building design in Mexico City requires architects and structural engineers to take a multi-hazard resilience approach to address problems that can result from





Left: Braced frame node schematic. Middle/Right: Simcenter Simsolid enabled SOM to generate analysis results five times faster than traditional FEA methods. (SOM)

earthquakes, winds and floods. Innovative, unique buildings that go beyond standard practices require additional external peer reviews to evaluate and ensure designs meet strength and serviceability. These extra peer reviews can significantly lengthen a building project.

The Antara Fase II building in Mexico City is an innovative high-rise tower designed by Sordo Madaleno Arquitectos with architecturally exposed brace-frames that contribute to the lateral load bearing structural system. As the structural engineer for the project, SOM developed the seismic resisting system, including

detailed evaluation of the steel braced frame connections, which underwent several design changes during the pre-construction phase. SOM engineers were experienced with traditional finite element method (FEM) analysis for non-standard connection design.



In addition to producing results five times faster, what was powerful was the correlation between Simcenter Simsolid results and traditional analysis methods, which supported our decision to use Simcenter Simsolid.”

Abel Diaz Valdes
PE SE Associate Principal
SOM

Solutions/Services

Simcenter Simsolid

[siemens.com/](https://www.siemens.com/simcenter-simsolid)

[simcenter-simsolid](https://www.siemens.com/simcenter-simsolid)

Customer's primary business

SOM, an initialism of its original name Skidmore, Owings & Merrill LLP, is a Chicago-based architectural, urban planning and engineering firm.

www.som.com

Customer location

Chicago, Illinois

United States

Their challenge arose from the time constraints placed on the project required to satisfy their client's deadlines.

Our solution

Engineers at SOM opted to use Simcenter™ Simsolid™ software, a mesh-free analysis solver that acts directly on imported computer-aided design (CAD) 3D models without needing to simplify the geometry. By eliminating both the time-consuming task of CAD geometry simplification and complex mesh creation, the engineers could readily import their CAD models into Simcenter Simsolid and generate analysis results five times faster than traditional FEA methods. What would typically take two weeks was completed in two days.

"Although speed is important, validation is critical," said Abel Diaz, PE SE associate principal, SOM. It was essential for the SOM engineers to verify that the Simcenter Simsolid results were accurate and reliable. With extensive validation examples, SOM was confident that using it would allow engineers to meet analysis requirements and project deadlines.

Results

Being able to quickly and reliably generate analysis results and visualize stress, strain and deformation with detailed contours accelerated SOM's workflow. Leveraging Simcenter Simsolid for the steel brace-framed connection analysis allowed SOM to complete a job that typically took weeks in just a few days – generating a fivefold time savings increase.

"In our process, validation is an essential step in adopting a solution" says Diaz.

"There is always a balance between ease of use, time savings and ensuring results make physical sense. In addition to producing results five times faster, what was powerful was the correlation between Simcenter Simsolid results and traditional analysis methods, which supported our decision to use Simcenter Simsolid."

Siemens Digital Industries Software helps organizations of all sizes digitally transform using software, hardware and services from the Siemens Xcelerator business platform. Siemens' software and the comprehensive Digital Twin enable companies to optimize their design, engineering and manufacturing processes to turn today's ideas into the sustainable products of the future. From chips to entire systems, from product to process, across all industries, [Siemens Digital Industries Software](#) – Accelerating transformation.

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For additional numbers, click [here](#).