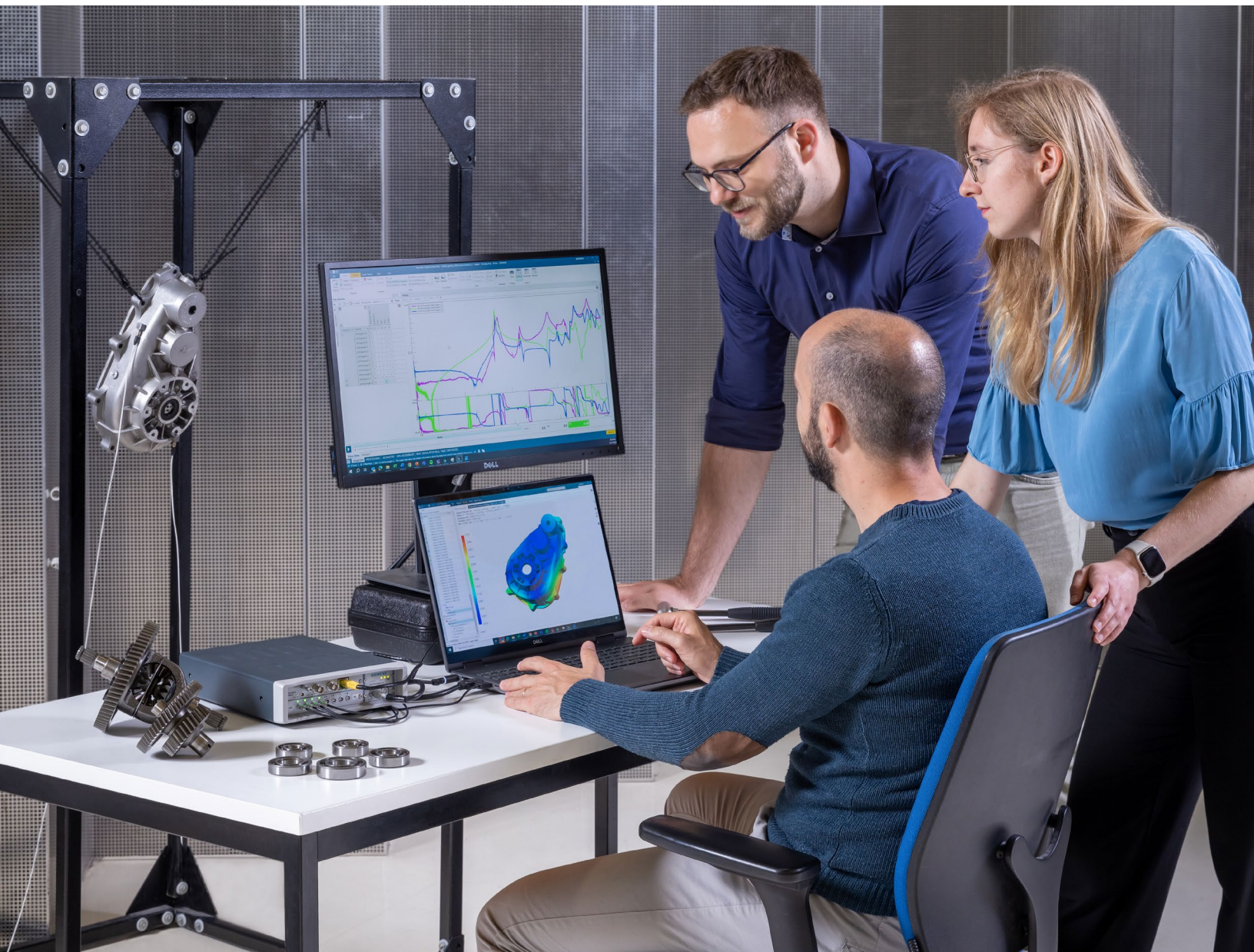


DIGITAL INDUSTRIES SOFTWARE

Simcenter testing solutions

Test faster, smarter and earlier in development

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



Testing tomorrow's products today



The constant drive for innovation and faster time-to-market is rapidly changing the landscape of product design and engineering.

Engineering teams are challenged to navigate the complexities associated with integrating the mechanical, electrical and logical components in new products. At the same time, they must manage the uncertainties that accompany innovation.

The intensive use of simulation and digital twin technology is the obvious approach to designing innovative products in shorter time. But the challenge lies in guaranteeing the accuracy of these simulations. Simulation lets you rapidly check the performance of many different designs, but how do you know if your simulations are accurately predicting real-world performance? This is where physical testing continues to play a critical role.

Simcenter™ software stands out in the industry by enabling companies to accelerate product design and engineering by uniquely connecting and integrating test and simulation workflows. Simcenter testing solutions, which are part of the Siemens Xcelerator business platform of software, hardware and services, provide the critical capability to correlate and update simulation models with data

Simcenter testing solutions integrate physical testing with simulation to reduce the number of physical prototypes.

and insights from real life. Additionally, engineers can predict key performance aspects of fully assembled products by combining test-based models of existing components and subsystems with simulation models of new components. Real-time simulation models combined with component testing facilitate the validation of hybrid virtual/physical prototypes on a system-in-the-loop (SiL) test bench.

Accelerating test-based product validation throughout the design cycle is crucial to eliminating full-scale prototypes. To support this challenge, using Simcenter enables the efficient testing of smart mechatronic systems by capturing all relevant physics and controls parameters in one effort. The close integration of instrumentation, data acquisition and engineering analysis delivers fast and accurate performance evaluation and validation. Remote connectivity and smart automation enable test teams to increase testing productivity by streamlining processes and accelerating data collection and validation. Above all, Simcenter testing solutions deliver superior measurement precision and data accuracy to provide high-quality insight for smarter decision-making.

Simcenter combines high-end data acquisition hardware with powerful data acquisition and analysis software to help engineers execute their test campaigns first-time-right, no matter the scale or complexity. Based on embedded industry expertise and an application-oriented approach, Simcenter testing solutions provide more insight in less time. As part of the broader Simcenter portfolio, Simcenter testing tightly integrates with numerous simulation solutions, facilitating collaboration between departments and helping companies deliver innovation faster and with greater confidence. Simcenter testing solutions help companies drive innovation and productivity in test-based engineering.

Test faster, smarter and earlier

Model the complexity

Deliver an accurate digital twin

- Feed models with real-world operational loads
- Continuously correlate, validate and update models
- Identify critical model parameters from testing

Explore the possibilities

Test earlier

- Convert unified test and simulation results into critical insights
- Validate design alternatives before producing physical prototypes
- Integrate physical components with virtual systems for real-time simulation
- Explore product performance while executing your test

Go faster

Test faster

- Streamline your test campaign from instrumentation to final report
- Reduce testing time with multiphysics measurements
- Automate data validation and processing

Stay integrated

Test smarter

- Enable collaboration between testing and simulation teams
- Integrate testing in the product development workflow
- Connect remote field test engineers with product engineers in the office



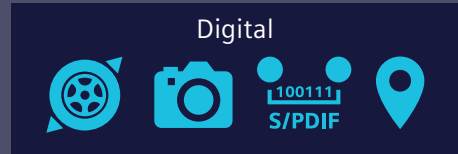
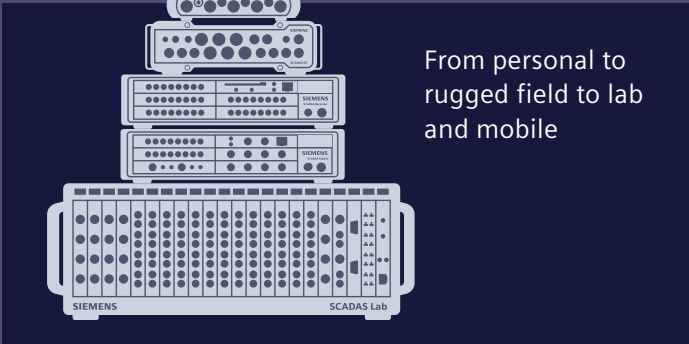


Thanks to all these features of Simcenter SCADAS RS, we estimate savings of one to two days over a two- to three-week testing program (a time savings of about 12 percent)."

Jongwoo Kim
Technology Part Manager
Hyundai Motor Company

The integrated portfolio for test-based engineering...

Multiphysics data acquisition hardware



Supports a variety of analog and digital transducers.

Data collection, analytics and modeling software



- NVH testing
- Durability testing
- Multiphysics testing
- Shock and vibration testing
- Transfer path analysis testing
- Model-based system testing
- Industrial quality testing

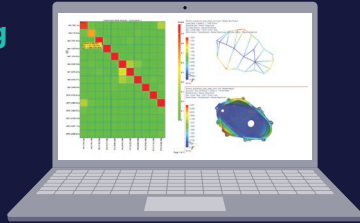
People and expertise



...to perform cross-domain performance engineering

Test for simulation

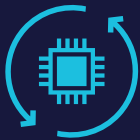
Correlation and updating



Measure loads with test

Use test data to correlate and drive simulation models for validating functional performance in a single environment.

Test with simulation



Hardware-in-the-loop (HiL)



Software-in-the-loop (SiL)



Vehicle-in-the-loop (ViL)

System-in-the-loop testing

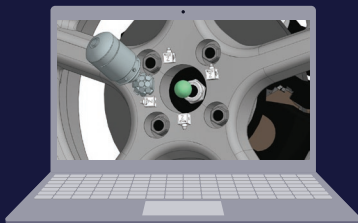
Use real-time simulation models to improve realism of subsystem testing.

fmi Functional Mockup Interface



Virtual sensing

Simulation for test



Virtual instrumentation



Simulation for troubleshooting

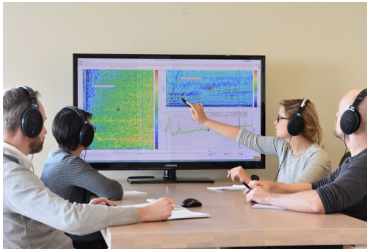
Use simulation models to define, improve and augment testing in a single environment.

Covering a wide range of disciplines

NVH

Noise, vibration and harshness (NVH) testing is used at all stages of the development process, including for benchmarking on proving grounds, detailed subsystems engineering and laboratory refinement on test benches and chassis dynos and final in-field product validation and certification.

The Simcenter NVH testing solution suite combines scalable acquisition hardware with the measurement, processing and analysis software to support a wide range of activities at different stages of the development cycle, including operational NVH testing, signature analysis, noise source identification, modal testing, (component-based) transfer path analysis (TPA), sound quality testing, pass-by-noise (PBN) testing, NVH prediction via virtual assemblies and more.



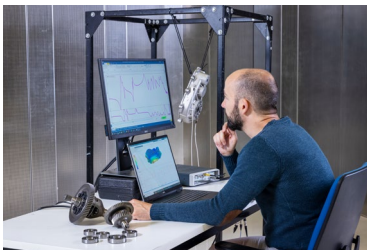
Acoustics

A compelling acoustic signature and sound quality are essential to innovative design. Sounds play a critical role in conveying the right message about a product's features and functionality. Simcenter testing covers a broad range of industry applications and acoustic engineering tasks and follows the latest international standards for designing, verifying and validating your product's sound.



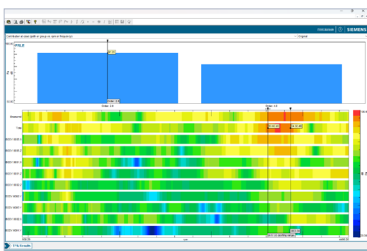
Rotating machinery

Rotating machinery testing is essential for optimizing performance while preserving reliability and low noise levels. Using Simcenter testing helps NVH engineers to optimize the performance of rotating machinery by enabling them to acquire and analyze the impact of speed, torque and control strategies on sound quality, (torsional) vibrations and energy efficiency. In the lab and in the field, using Simcenter multidisciplinary testing systems save time, increase data reliability and maximize insights into the machinery's behavior.



Structural dynamics

Modal analysis is key to exploring solutions for structural weaknesses with simple impact testing, large-scale modal surveys or validating 3D finite element (FE) models with experimental data. Simcenter testing solutions include state-of-the-art modal parameter identification methods that help engineers focus on the problem's root cause while substantially reducing lead time.



Transfer path analysis

TPA allows quantifying and modeling energy sources and paths, revealing the most important ones to ultimately optimize the NVH performance of systems at given receiver locations. The Simcenter testing solutions workflow-based setup helps engineers trace the root cause of NVH issues by guiding them through complex TPA techniques.



Durability

Durability testing is needed to deliver long-lasting designs. Acquiring and analyzing load data is key to optimizing material strength and fatigue performance. Simcenter testing integrates rugged and reliable data acquisition hardware with comprehensive data collection and analysis software, guiding engineers through the complete testing process.



Shock and vibration

Certification and qualification of products require specific dynamic tests whereby external excitation – shock, vibration and noise – is applied. Simcenter integrates an effective, high-speed multichannel closed-loop shaker control system with parallel data acquisition and powerful analysis capabilities. It features comprehensive time data replication applications, advanced functionalities for multi-axis vibration testing and acoustic field control and is perfectly safe for vibration and acoustic qualification of space systems.



Data management and analytics

As the amount of data from physical and virtual testing campaigns continuously grows, it's crucial to organize and keep track using data management and analytics. With Simcenter testing solutions, current and historical data can be rapidly retrieved and interactively or automatically visualized regardless of source. Powerful and smart displays speed up analysis and a wide range of data processing capabilities. By automating repetitive tasks, even more time is saved while errors are reduced. Thanks to scalable data annotation capabilities, with Simcenter you can automatically transform data into concise and active reports without losing vital information.



XiL

X-in-the-loop (XiL) testing, also known as "hardware-in-the-loop (HiL)/system-in-the-loop (SiL) testing, is a cutting-edge hybrid approach that combines real-time simulation and real-world physical testing to validate complex mechatronic systems. By immersing physical subsystems in virtual environment simulations, XiL testing enables faster and more cost-effective product development processes while ensuring real-world conditions are accurately represented. The Simcenter industrial real-time platform enables engineers to replicate real-life scenarios while testing mechanical hardware earlier, faster and smarter.



Industrial quality testing

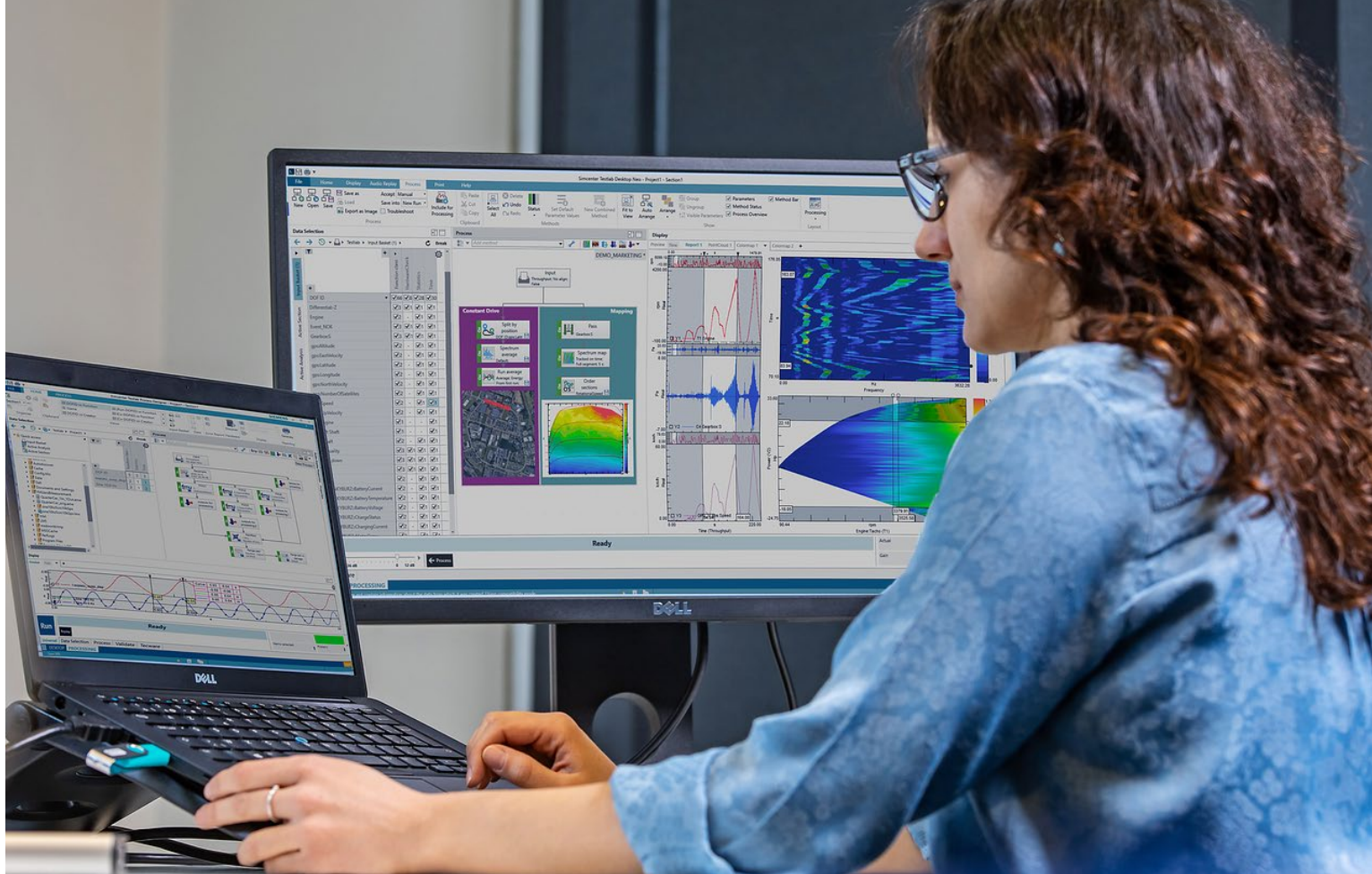
Using a series of test measurements to ensure quality standards are met is a vital part of quality assurance (QA) and production teams. Using vibration and sound measurements, Simcenter industry quality testing solutions can be leveraged to perform process-secure, fully automated and highly reliable fault detection under volume production conditions. Simcenter industrial quality testing solutions combine all necessary sensors, accurate sound and vibration signal recording hardware, smart signal analysis and flexible test bench control software to precisely perform pass or fail checks.



Using Simcenter Testlab virtual prototype assembly expanded our applications for NVH prediction by a factor of five. This has drastically increased productivity.”

Philippe Mordillat
Noise, Vibration and Harshness Simulation Expert
Renault





Data collection, analytics and modeling

Simcenter Testlab™ software combines data collection, analytics and modeling into a single software suite for multidisciplinary, test-based performance engineering. It is designed to make individual users and complete teams more efficient. Simcenter Testlab is an excellent software for future-focused testing departments, offering the right balance between ease-of-use, engineering flexibility and closing the loop with simulation. Using Simcenter Testlab significantly increases a test facility's productivity, delivering more reliable results, even when the availability of prototypes is dramatically reduced.

Speed up data collection

- Accelerate test preparation
- Introduce standardized tests in advanced engineering
- Validate acquired data immediately and reduce costly testing time

Convert measurements to insights

- Carry out interactive and automated multidisciplinary analytics
- Identify the root cause and compare two datasets promptly
- Share your insights and reports easily

Connect to simulation

- Provide simulation with real-life loads and models
- Correlate simulation and test results on the spot
- Embed simulation models in the test setup

Multiphysics data acquisition

Simcenter SCADAS™ hardware for data acquisition helps engineers increase productivity by delivering the data quality and format required to get the job done right the first time for a wide range of analog and digital sensors. The range of Simcenter SCADAS includes handheld solutions, compact and portable mobile units, autonomous smart recorders, rugged solutions for harsh environments and high-channel-count laboratory data acquisition systems.

The flexibility, performance and precision of Simcenter SCADAS makes it an excellent choice for a wide range of multiphysics measurement applications at any scale in the lab or field. All Simcenter SCADAS hardware is optimally tuned for acoustic, vibration and durability engineering, and is seamlessly integrated with Simcenter Testlab for accelerated test setup and correctly formatted results. It represents a secure investment that can easily be extended to the scale of your measurement requirements.

Flexibly fitting industry needs

- Handheld, mobile, autonomous, rugged and laboratory solutions
- Universal modules to optimize investments
- Mix-and-match mobile and laboratory configurations

Superior precision and data quality

- State-of-the-art signal-to-noise and dynamic range
- Ultra-low noise floor and highly precise phase match
- Precise time-synchronized data in any configuration

Sheer measurement productivity

- Condition a wide range of analog and digital sensors to perform multiphysics testing
- Standardize, automate or autonomously run tests
- Capacity of hundreds of channels at once, distributed or centralized
- On-the-spot data validation during tests via remote connectivity

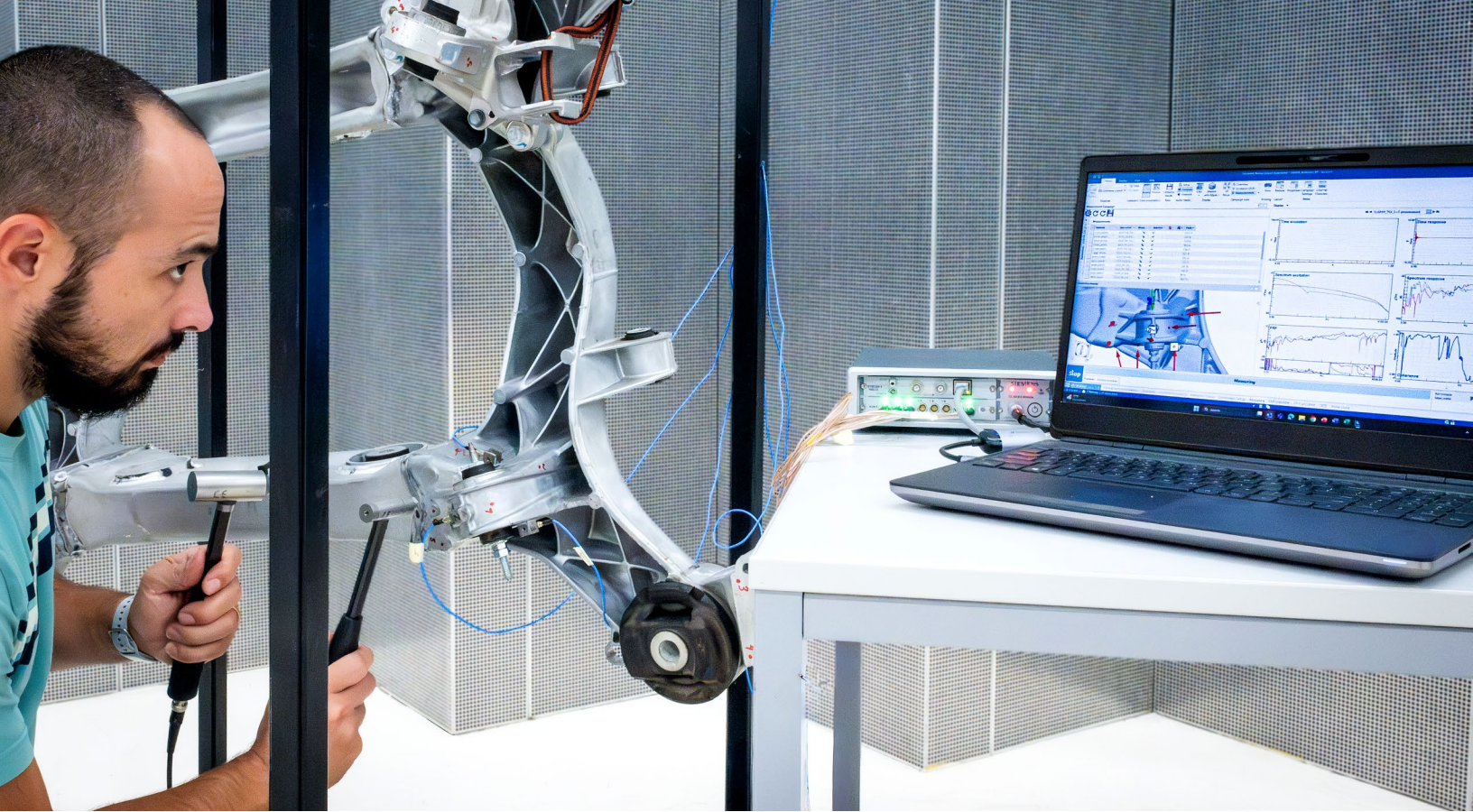


We chose Siemens Digital Industries Software as a partner because they have experience working with digital twin technology in other industries and possess a wide branch of software that can support this development.”

Kim Branner

Senior Researcher
DTU Wind Energy
Technical University of Denmark





A complete testing system for automotive OEMs and suppliers

The automotive industry is facing new challenges, leading manufacturers to adapt their approach to physical testing. With fewer prototypes available, there is a growing emphasis on maximizing the value of NVH, durability or any other data and automating testing processes to increase efficiency. Consequently, the pressure on test engineers to perform tests accurately the first time has increased, necessitating tools that enhance efficiency from instrumentation to results reporting.

Complete suite for NVH testing

With electric vehicles (EVs), NVH testing poses several challenges, including the need for comprehensive real-time data acquisition and analysis, accurate sound quality evaluation and modal analysis. Moreover, integrating NVH testing with the broader vehicle design and simulation processes presents a challenge in achieving seamless collaboration and data exchange between simulation and test. Using Simcenter offers a complete suite of NVH testing tools for specific EV considerations.

Efficiently predict system-level NVH performance

With few prototypes available, development teams need to know how the noise and vibration sources from electrified vehicles contribute to overall NVH performance.

Using Simcenter Testlab allows you to accurately create or assemble a virtual vehicle without a physical prototype based on test and simulation data for various vehicle components. This lets you easily evaluate the effect of modifications or components on NVH performance of the full vehicle at different development stages and maximize the use of all the data in the organization.

Simcenter testing solutions

Combine real-time simulation and real-world physical testing

As companies strive to achieve zero full-scale prototypes, the growing number of product variants makes physically testing all combinations impractical. One way to reduce dependency on expensive full system physical prototypes is to immerse physical subsystems in virtual environment simulations. XiL testing, a holistic approach combining real-time simulation and real-world physical testing, allows you to accommodate system configurations and evaluate many variants and complexities.

Simcenter Testlab provides a real-time platform that offers efficient switching between test configurations and easy test updating directly on the platform. It is a powerful and versatile platform to virtualize the operational environments of physical systems.

Streamline vehicle durability testing

Durability testing takes time to accurately capture road loads or to determine how long a component will last. However, durability testing teams are under increased time pressure while having limited access to vehicle prototypes.

Using Simcenter uniquely integrates rugged and reliable data acquisition hardware with comprehensive processing and analysis software features to help shorten durability testing time. Using Simcenter covers every step of a typical test campaign, from channel setup and measurements to validation, consolidation, analysis and reporting. This one-stop testing solution covers all durability testing profiles for road and dedicated test rigs.

Deliver product quality during manufacturing

Simcenter provides a robust and reliable noise- and vibration-based end-of-line testing system that can be easily integrated into end-of-line test benches and production lines in the automotive industry.



Simcenter testing covers many key automotive applications, such as:

- NVH operational testing
- Powertrain noise and vibration testing
- Signature analysis
- Torsional vibration analysis
- Modal testing, analysis and correlation
- Component-based transfer path analysis
- Creation of virtual assemblies for NVH prediction
- Sound quality testing and analysis
- Acoustic material testing
- Noise source identification
- Sound power analysis
- Pass-by noise testing
- Aeroacoustics testing in wind tunnel
- Active sound design
- Road load data acquisition
- Load data analysis
- Accelerated testing
- Component vibration qualification testing
- Data management and data analytics
- Process automation using tailored processes



High-end testing solutions for aviation and space industries

Innovations in material engineering and digital technologies for structures, system performance and lifecycle management are disrupting aviation and space industries. These target improved efficiency, mission range and lifetime without compromising safety and reliability. New players approach the market with different business models and processes, putting established original equipment manufacturers (OEMs) under pressure. Consequently, qualification and certification testing are more complex yet need to be performed under ever tighter schedules. Meanwhile, the new technologies require lots of additional validation work.

Powerful and precise performance testing

Aircraft programs are adopting new technologies such as composite structures, distributed electric propulsion and innovative vertical takeoff and landing (VTOL) configurations. These advancements introduce integration challenges that significantly complicate performance engineering. For instance, to assess the risks of flutter or ensure acoustic comfort in the cabin, original equipment manufacturers (OEMs) must use validated dynamic models to understand the structural behavior of subsystems. This necessitates versatile testing tools capable of collecting precise data while seamlessly integrating with simulation processes.

Furthermore, during the certification process, engineers require specialized and efficient solutions that can help them expeditiously navigate extensive standardized campaigns while also linking the collected data to the requirements verification digital thread.

Securely testing precious structures

In the aerospace industry, mechanical qualification tests are often conducted on costly prototypes or even the actual spacecraft, which comes with a high risk of damage to critical hardware. It is essential to preserve the integrity of these valuable, scarce technical qualification models or flight-ready spacecraft. To ensure these large, sensitive and expensive structures can withstand challenging conditions like those experienced during launch, rigorous safety measures are crucial.

To prevent structural damage, test engineers need solutions that offer high-channel-count capacity, precise replication of acoustic and mechanical environments and robust closed-loop control systems. Other methods like direct field acoustic testing enables testing beyond the constraints of limited, high-cost facilities.

Simcenter testing solutions

Advanced engineering solutions for marine

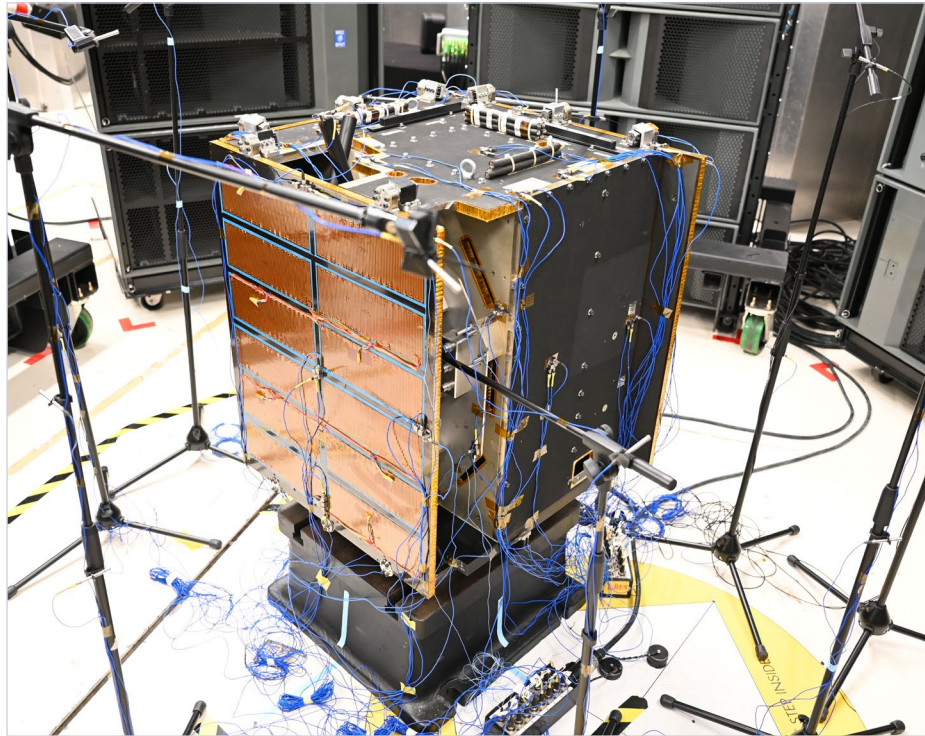
These industries are focused on improving the reliability and safety of systems. In the naval sector, for example, advanced stealth technologies for ships and submarines are vital to achieving and maintaining acoustic superiority. To validate and optimize these high tech innovations, companies are turning to advanced testing solutions such as multiple input and multiple output (MIMO) testing, TPA and advanced data acquisition systems. These solutions enable these industries to stay ahead of competition and maintain operational excellence.

Pioneering aerospace testing

Simcenter testing combines ultra-large-scale testing capabilities with embedded industry expertise to achieve increased productivity during standardized certification tests. It is an open platform that facilitates collaboration between teams and seamlessly connects to simulation. More efficient product design and verification is possible due to innovative hybrid testing technologies such as real-time SiL testing, virtual sensing or virtual prototype assembly.

Simcenter testing solutions cover the following key applications for aviation and space:

- Experimental modal analysis
- Ground vibration testing
- Acoustic certification
- Sound source localization
- Jet engine testing
- In-flight testing
- High-channel-count data acquisition
- Shock and vibration testing
- Direct field acoustic noise testing and closed-loop acoustic control
- MIMO testing
- Micro-vibrations testing
- Mechanical HiL testing
- Component-based TPA and virtual prototype assembly



We can easily see a factor of 10 in terms of time-saving improvements with our new Simcenter system."

Carine Pont

Mechanical Test Manager
Airbus Defense and Space

Flexible solutions that apply to any manufacturing industry

Evolving trends such as product and process digitalization, the introduction of new materials and smart functionalities, mass customization and the growing importance of systems engineering are taking hold in all manufacturing industries. Oftentimes, these new methodologies/materials are used in performance areas such as vibration, noise, efficiency, service life and more. It is crucial to balance all these performance areas in all manufacturing industry applications.

For example, heavy equipment needs to operate in harsh conditions and deliver peak power so it is vital there is a direct relation between efficiency and operational cost. Then there are regulations regarding noise. White goods and consumer electronics must operate quietly and efficiently while withstanding the operational vibrations for the designed lifetime. For industrial machinery and certain medical devices, vibrations should not affect precision. Companies in the energy and utilities industry count on efficient and uninterrupted operation while respecting environmental legislation. In the marine industry, different priorities apply for

manufacturers of cargo vessels, where the challenge is reliability, and luxury yachts, where the challenge is vibration and acoustic comfort.

With Simcenter testing, manufacturers can find the right applications to address their concerns. Partners around the globe and across industries value Simcenter testing for combining versatility with scalable solution depth and embedded engineering expertise.

- Vibration and acoustic troubleshooting
- Root-cause analysis using source transfer receiver
- Impact testing and modal analysis
- Operational modal analysis
- International Organization for Standardization (ISO) sound power
- ISO human body vibration
- Sound source localization
- Sound quality engineering
- Vibration qualification testing





Simcenter helps us set up quick and reliable component tests with minimal effort. All necessary functions are integrated within one software solution, making data conversion unnecessary."

Matthias Patalong
Development Engineer
Hilti Competence Center for Health & Safety Technologies



S
life

SIEMENS
SIMATIC 3ES7 31-1EX30-0AB0



Extend your expertise with engineering and consulting services

Supporting you at any stage

You can get support from the Simcenter team during any stage of the product development cycle, from the smallest outsourcing tasks to full program management.

Transferring technology know-how

The Simcenter team helps you achieve and deploy the digital twin by providing engineering training in the latest tools and technologies used in the most competitive product development programs. Our consultants participate at each level and every stage of engineering projects. Your engineers will be involved in every step as our experts demonstrate established methodologies and conduct a technology transfer consisting of critical application know-how and best practices.

Implementing the state-of-the-art

Our consultants can assist you in implementing and applying state-of-the-art technologies, such as artificial intelligence (AI) and the digital twin in your

development process. Our team can assist you in coupling these leading-edge concepts with your current development technologies, enabling your engineering teams to streamline their product development processes and validate their design ideas faster.

Providing global testing facilities

Simcenter Engineering and Consulting services operates dedicated testing facilities around the world. They include in-house structural testing labs, anechoic and reverberant rooms and NVH/durability test benches equipped with multiple multichannel mobile and laboratory testing and analysis systems.

Integrating test and simulation

Simcenter experts can assist you in implementing our approach that combines test and simulation to help you front-load design decisions, accurately assess multiple design concepts and make objective, performance-related architectural choices.

Maximizing engineering value with customer support

At Siemens Digital Industries Software, becoming a Simcenter customer means more than purchasing world-class solutions; it opens the door to a wealth of engineering proficiency. Our technology is backed by a global team of experts dedicated to helping our customers' engineering departments meet the challenges of their industry and exceed the expectations of their market – ultimately leading to success.

Simcenter testing solutions customer support is an integral part of Siemens' comprehensive support services. With a strong commitment to customer satisfaction, our dedicated team is readily available to provide assistance and guidance for all your testing needs. From installation and configuration to troubleshooting and optimization, our customer support team is equipped with the expertise to address any challenges you may encounter. We offer various support channels, including phone, email and online resources, to enable you to receive timely and personalized assistance. Additionally, our support services encompass software updates, maintenance and training programs to help you stay

up-to-date and maximize the benefits of Simcenter testing solutions. Siemens customer support delivers exceptional service and enables you to achieve your testing objectives with confidence.

In addition to our comprehensive support services, Simcenter Customer Support also offers on-premises, instructor-led training programs. These training sessions are designed to provide hands-on learning experiences tailored to your specific needs. Our experienced instructors will guide you through the intricacies of our testing solutions, making sure you have the knowledge and skills to effectively use the software for your testing processes.



The Siemens Digital Industries Software specialists offer us first-class support and training. We've had a good relationship with them for many years. They organize learning events, offer us a lot of materials in the local language, and they host public discussion forums where more than a thousand professionals exchange ideas."

Liu Erbao
Director, Body NVH Engineering
Great Wall Motor

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.

Americas: 1 800 498 5351

EMEA: 00 800 70002222

Asia-Pacific: 001 800 03061910

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