



DIGITAL INDUSTRIES SOFTWARE

Simulate real-world physics

Master the increasing complexity in today's heavy equipment designs

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SIEMENS

Effectively design innovative equipment

Digital capabilities, autonomous operation and electrification are revolutionizing the heavy equipment industry. As original equipment manufacturers (OEMs), you can't afford to miss out. Your ability to turn these technologies into groundbreaking applications and business models will define your future.

To be successful, you must rethink the role of simulation. Such innovations complicate designs as they lead to a massive number of variables, more types of physics with stronger interactions and after-delivery product updates. An iterative process where you make manual choices and then use simulation to virtually validate one discipline after the other won't work.

Instead, you need a predictive approach that lets you consider all aspects simultaneously and explore the design space based on realistic models of equipment, duty cycles and boundary conditions. Applying real-world physics simulation in this way will help you master complexity, reduce the need for physical prototypes, certify designs earlier and save time and money.

Key drivers of change

Environmental concerns. Our environment and resources are under pressure. In particular, climate change is confronting us with an unprecedented challenge. We all need to act to turn the tide.

Demographic evolution. Continuous urbanization greatly impacts the environment and the logistics of providing goods. But it also drives young people out of rural areas, where labor shortages can be a problem.

Industry trends

Electrification

This is a vital instrument to combat climate change. The strong interaction between mechanical and electrical components, as well as software and controls, complicates design.

Increased safety regulations

Growing health and safety awareness is a positive evolution. But meeting more ambitious targets means reducing design margins, which requires more accurate predictions of equipment performance.

Connected worksites

IoT-capable equipment can feed back real-world data into your product lifecycle management (PLM) system for continuously optimizing performance and predictive maintenance. Such applications require real-world physics simulation.

Autonomous operation

Autonomous equipment will reduce the need for human labor in remote areas. Refining the algorithms requires millions of virtual duty cycles in real-world simulations.



Achieve simulation excellence

Real-world physics simulation is a continuous effort that must start at the beginning of a project. You can only master complexity if you take control from the beginning. During conceptual studies, you must include all relevant physics in comprehensive models for all components. They must be suitable for multi-disciplinary analyses so you can strive for the best design considering all the equipment's functional performance requirements. Further development is about fine-tuning the balance between them, using increasingly realistic models.

Therefore, you need to add details as soon as they become available. Real-world physics simulation requires actual data. At some point, you will need discipline-specific methods to properly describe all physical aspects. Typically, this dramatically increases computational requirements, as the usual technologies involved are finite element analysis (FEA), multibody analysis, computational fluid dynamics (CFD) and the like. The challenge is to apply such methods in coupled models and co-simulations

to create reduced versions for applications that require real-time results, and to keep models consistent across disciplines.

The latter may sound straightforward, but with departments studying various design aspects, you can easily end up working in silos, which complicates collaboration and data exchange. To avoid creating multiple model versions as the process evolves, you must remove these silos by integrating solutions, activities and data into a common digital platform that everyone can access and in which every decision is traceable. You must be able to weave a digital thread throughout the entire product lifecycle, as innovative equipment continues receiving updates after delivery.

Siemens Digital Industries Software provides such an end-to-end process for real-world physics simulation in the Xcelerator portfolio, its comprehensive and integrated portfolio of software and services.

Must-haves

A scalable platform

By including the most diverse modeling technologies and simulation workflows, our solutions are scalable in all dimensions, from component to integrated product, from system models to computer-aided design (CAD) to detailed simulation, from concept to validation.

High-end solutions

Our offering unites among the most powerful simulation solutions available today. We achieved this by making substantial investments in research and development (R&D) as well as strategic partnering and acquiring technology pioneers that can present decades of engineering expertise.

Integration of solutions, activities and data

All our solutions are backed by an open, flexible and integrated digital infrastructure where all data regarding product lifecycle phases are collected, managed, kept current and made accessible for all relevant stakeholders.



Unlock unique synergies

Take simulation to a different level

Working with Siemens on real-world physics simulation presents unique advantages. For example, we use the technologies that we sell so we understand that digitalization is more than connecting data throughout the lifecycle. At a certain moment, the equipment needs to become real. That creates challenges that cannot be understood by virtual-only approaches. At Siemens, we link the virtual and the physical world.

Having that proficiency will allow you to exploit real-world physics simulation to its full potential. An example would be deploying bi-directional connectivity between physical assets and their virtual counterpart in the context of IoT. It is impossible to deliver such innovations without combining knowledge of real-world physics simulation with experience in manufacturing, data management, IoT, rapid application development and more.

Align all your departments

Innovating equipment means exploring uncharted design areas. Without continuous testing to validate new components, materials, boundary conditions and more, you can never model them realistically. At the same time, simulation can help you to prepare measurements by indicating the best locations for sensors or excitation devices. Test and simulation departments can achieve enormous synergies by aligning their workflows. Siemens is the only company that combines both worlds.

In addition, we promote vertical integration across departments by making our expert solutions accessible for analysts and occasional users with associative connectivity between simulation and CAD. In this way, we further support early decision-making. We also enable creating comprehensive templates that capture enterprise-wide processes. This helps standardize the templates and processes and is a good basis for large-scale workflow automation.



Your benefits

- Connect with the physical asset
- Broaden the scope of simulation
- Combine simulation and test
- Make simulation accessible

“With an integrated digital twin platform, we see major potential in speeding up the product development process, reducing prototypes, increasing traceability and thus improving quality and reducing development costs.”

*Juha Pankakoski
Executive Vice President of Technology
Kronecranes*

Siemens' Predictive Performance Engineering for heavy equipment

Using Siemens Predictive Performance Engineering for heavy equipment empowers manufacturers to increase efficiency and improve productivity with a personalized, adaptable, open-source solution that includes the most comprehensive digital twin.

Today, our solutions help companies of all sizes leverage digitalization to produce innovations that meet tomorrow's challenges.

For more information on Siemens Predictive Performance Engineering for heavy equipment, go to [siemens.com/ppe](https://www.siemens.com/ppe)

"The only way to design a market-leading, optimally weight-efficient truck is with advanced simulation tools. We can't maintain market leadership another way."

*James Whitfield
General Manager, Research and Development
Liebherr Group*



About Siemens Digital Industries Software

Siemens Digital Industries Software is driving transformation to enable a digital enterprise where engineering, manufacturing and electronics design meet tomorrow. Xcelerator, the comprehensive and integrated portfolio of software and services from Siemens Digital Industries Software, helps companies of all sizes create and leverage a comprehensive digital twin that provides organizations with new insights, opportunities and levels of automation to drive innovation. For more information on Siemens Digital Industries Software products and services, visit [siemens.com/software](https://www.siemens.com/software) or follow us on [LinkedIn](#), [Twitter](#), [Facebook](#) and [Instagram](#). Siemens Digital Industries Software – Where today meets tomorrow.

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