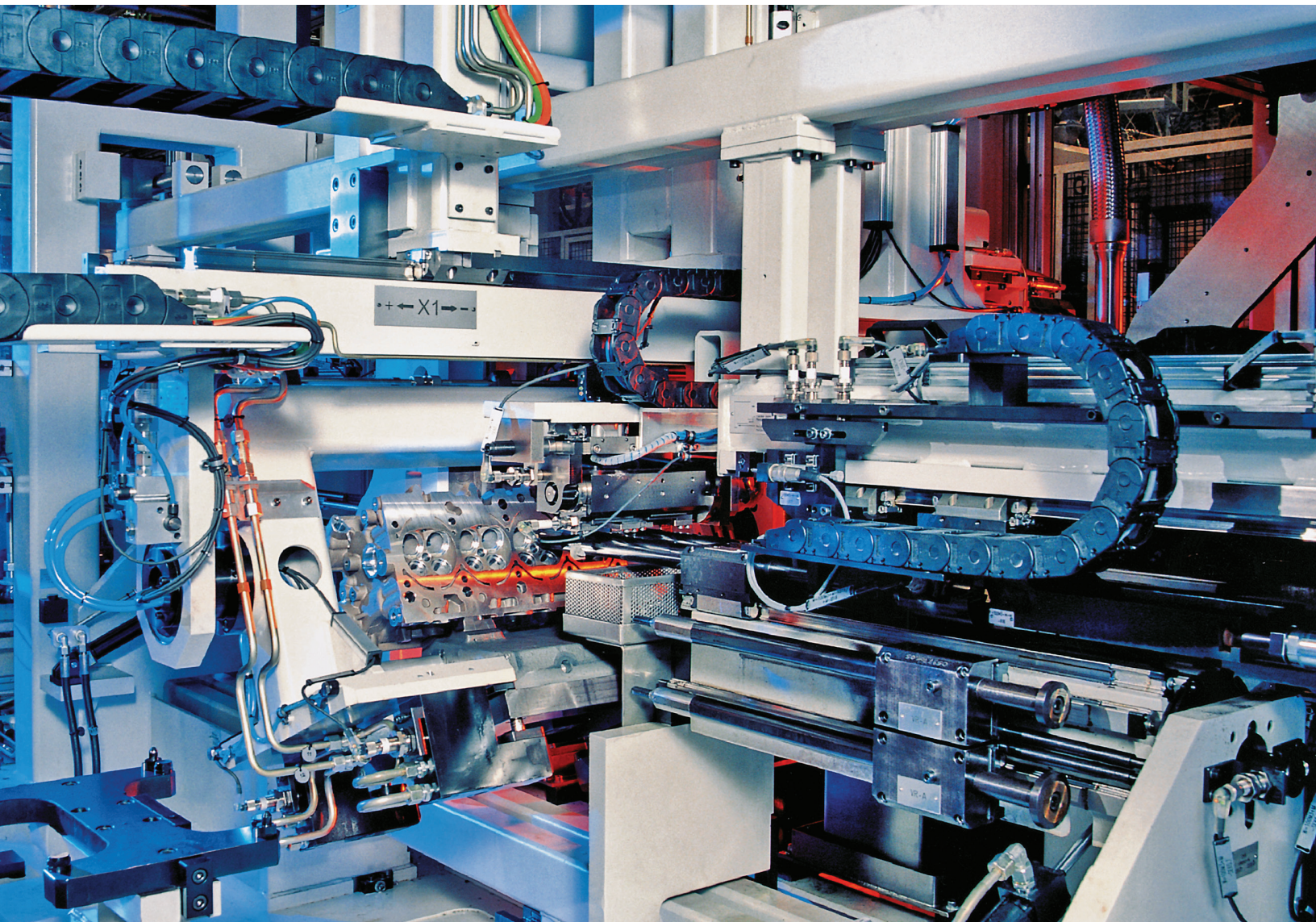
SIEMENS

DIGITAL INDUSTRIES SOFTWARE

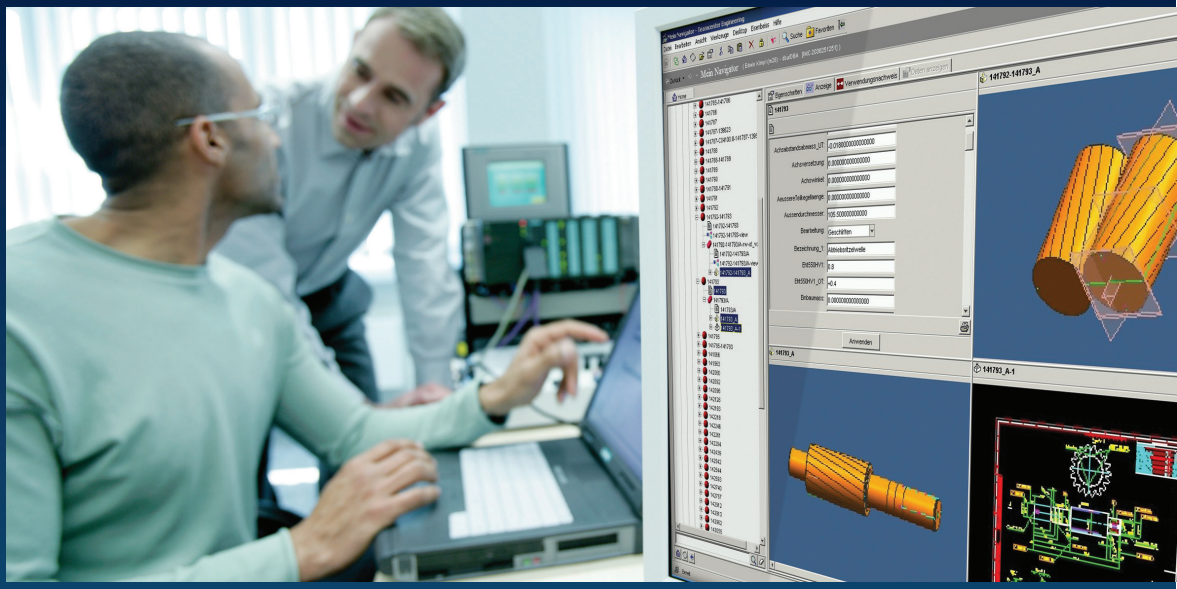
Industrial machinery

Siemens helps machinery manufacturers realize innovation

siemens.com/software



Today's industrial machinery industry

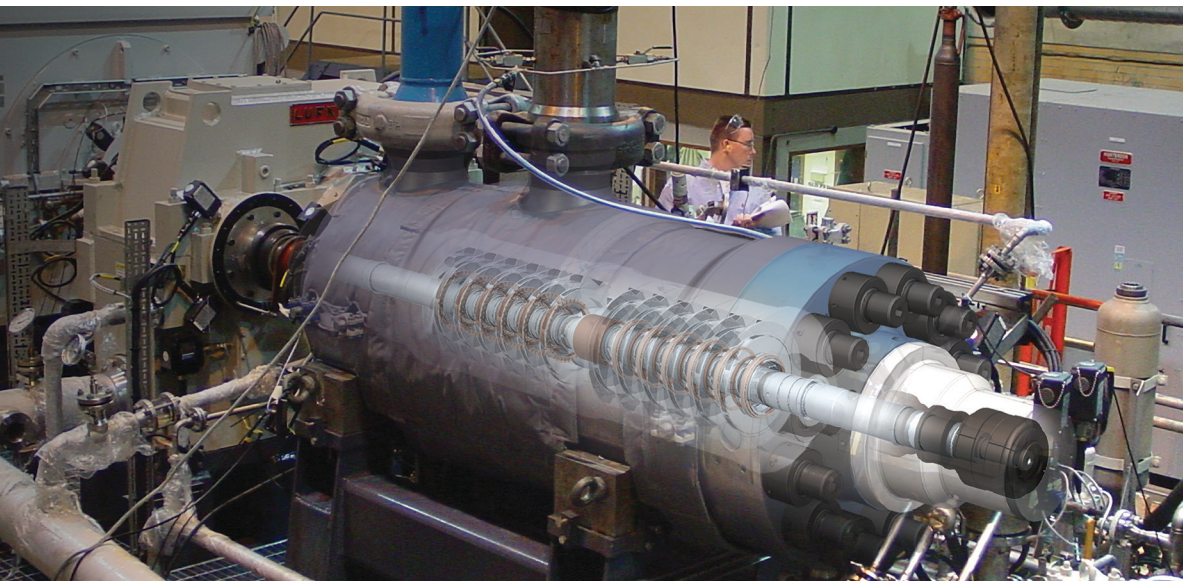


Increasing demands for automation and smarter machines are driving industrial machinery companies like yours to continuously innovate and optimize their products. The need to capture and leverage fresh value-creating ideas from your employees, as well as from your partners, customers and suppliers, extends today's innovation process beyond traditional boundaries.

Innovation has become a core driver of growth, performance and valuation. You need to accelerate product delivery while ensuring a fast and appropriate return on your innovation investments. These goals are compounded by the fact that today's new product development process is comprised of hundreds of decision points and parallel workflows that now take place in a global context.

Siemens Digital Industries Software addresses these realities by providing a product lifecycle management (PLM) platform that enables your company to react quickly to new challenges in your business environment, allowing you to adapt to external disruptive influences.

Business challenges



Industrial machinery manufactuers are constantly challenged to adapt to new cirucmstances. With the introduction of Industry 4.0, many machine builders have encountered new obstacles, such as the use of decentralized, autonomous machines that communicate with one another to optimize production.

These challenges have added a new layer of technological complexity. Many industrial machinery manufacturers find themselves facing an increasing number of new requirements, such as the demand for more flexible machines that can be rapidly adapted to new products or formats, as well as for machines that can be easily integrated into existing plants.

With the advent of cloud-based solutions, manufacturers willing to digitally transform their standard operating procedures will be in a strong position to keep up with forthcoming industry trends and machine operator demands. In order to meet these demands, industrial machinery manufacturers must:

- Integrate disciplines to rapidly and efficiently deliver machines against changing customer requirements
- Swiftly configure machines to meet customization demands and validate against energy expectations and global regulations
- Use virtual models (the digital twin) to simulate, test and improve machine performance without the need of physical prototypes
- Enable complete production information visibility for designers, engineers and suppliers - driving greater collaboration and efficiency into the machine development process

To understand all of this complexity, let's take a closer look at the trends permeating the industrial machinery landscape.

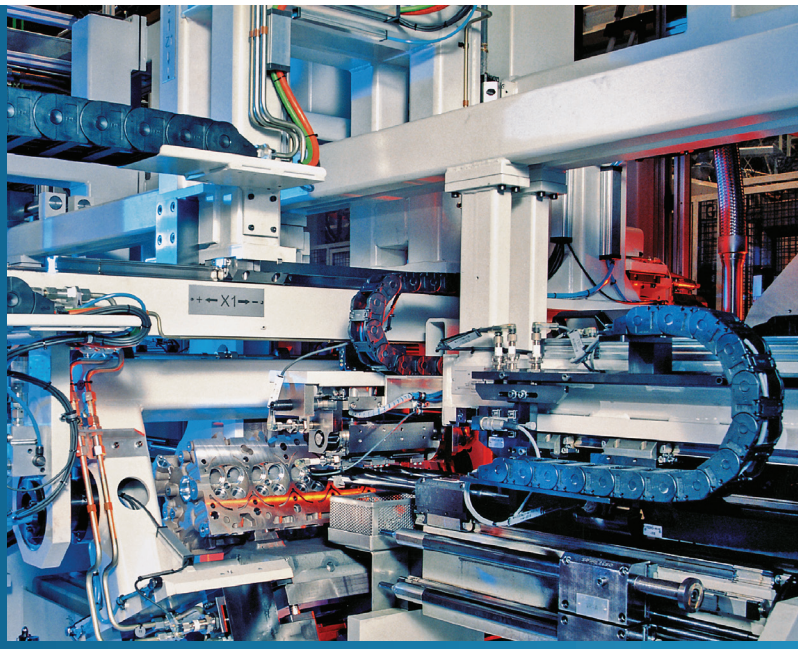
Industry trends

Disruptive influences

Thanks to socio-geopolitical factors, today's industrial machinery landscape faces new obstacles, such as supply chain shortages. This issue has left many machine builders unable to complete order backlogs, delaying products to market, and leading to a loss in revenue and future business opportunities. Concurrently, older generations are retiring from the workforce at an accelerated rate, leading to a loss in valuable "tribal knowledge," while more workers expect teleworking options – leading to a labor gap as machine builders struggle to hire high-quality, in-person workers. Compounding these issues are entrepreneurs entering the market, as they upset the market status quo since they are not encumbered by legacy processes and technological bottlenecks.

Smarter machines

Changing consumer preferences are driving product manufacturers' need for highly agile, flexible machines that can create a variety of products. To meet this demand, machine makers need machines that increasingly integrate hardware, software and services as one cohesive umbrella. These machines must make use of greater automation and integrated quality tools to provide machine builders with a competitive differentiation.



Business model changes

Industry 4.0 technologies are reshaping the business from one built around machines, to one focused on services and integrated solutions. Concurrently, many machine builders are experiencing market pressures to not only increase the sustainability of their own operations, but to also support the sustainability goals of their customers. The digital and ESG transformations underway at many industrial machinery and equipment companies are paving the road for a great transition from a product-centric business model, to a solutions-centric model.

Sustainability

More than 90 percent of the lifecycle cost of today's machinery comes from running the machine. When you factor this in with the rising cost of energy, it is easy to see how innovative methods for making your machines more energy efficient deliver a significant competitive advantage. Today's manufacturers also want to establish this advantage by reducing the amount of waste (water and grease) that their machines produce. In addition, they try to adopt the best approach for recycling machine components/parts and for complying with today's voluminous government regulations. Finally, it is important to ensure worker safety by incorporating sensors and controls into today's machinery designs. All of these sustainability factors can be optimized through digital, cloud-based solutions. Such solutions help companies harness machine design and manufacturing complexity through collaborative workspace options, in addition to providing data transparency.

Industry solutions

To harness today's industry trends and overcome business challenges, machine builders must leverage digitalization. Digitalization, or the process of transforming the enterprise via technological tools, is paramount to maintaining market share against global innovators who have already begun their own digital transformation, or who are new to the market and uninhibited by existing processes/technology.

Digitalization begins and ends with an advanced machine engineering approach. Through this approach, machine builders can realize three core competencies that differentiate them from the competition: next generation machine design, where disciplines integrate to rapidly deliver and validate against customer requirements; the digital twin of machinery, where virtual models simulate machine capabilities and suggest engineering improvements without the need of a physical prototype; and the effective delivery of complex projects, where collaboration between the disciplines enables greater transparency and data reuse, so projects can be scaled and delivered to market quickly.

Let's breakdown what each of these three core competencies look like, and the advantages they provide to machine builders.

Next generation machine design

With next generation machine design, machine builders can add a full suite of digital tools to their arsenal, ranging from product lifecycle management (PLM) tools to simulation and manufacturing software. Most importantly, all of these cloud-based tools can integrate and speak with one another, while their open architecture allows them to sync with other tools within one's tech stack. This means machine builders can readily break down informational silos, driving greater accuracy and efficiency into the machine development process.

By integrating mechanical, electrical, electronic, software and other disciplines, machine builders can align on changing customer requirements. The sooner disciplines align, the sooner important decisions can be incorporated into the design process, eliminating potential errors that could arise in the late stage of machine development where the cost of fixing issues is much higher – thus, saving machine builders valuable time and resources.

Furthermore, this alignment helps organizations validate their machines against industry regulations, energy expectations and other key factors pertinent in producing the most optimized, agile machinery. Alignment also enables the use of modular design, where information such as the bill of material are stored within "blocks." These "blocks" can be referenced and updated at any time; thus, they enable easy and swift data reuse. This means machine builders can scale projects and readily respond to customization demands. They can expedite a machine's creation, delivering their product to market faster than competitors.

Additional capabilities encompassed by next generation machine design include...

Product design: Rapidly produce precise models for visualizing, sharing and validating product designs, driving greater flexibility and efficiency into their design process.

Automation engineering: Use virtual commissioning tools to debug programmable logic controller (PLC) codes before downloading them to real equipment – ensuring faster start times and reduced downtimes for production.

E/E Systems Development: Accelerate the development of complex E/E systems with comprehensive tools that drive traceability and compliance across embedded software, electrical, electronics, and network communications.

Application lifecycle management: Connects disparate teams and projects with application lifecycle management; this solution helps one effectively manage application variations, drive mass customization for products and provide a 'configured to order' option for deliverables.

Performance engineering: Optimize design and deliver innovations faster through a unique combination of 3D CAE, physics-based system simulations and machine data analytics to predict performance across all critical attributes earlier and throughout the entire product lifecycle.

Manufacturing planning: Plan, optimize and validate your manufacturing processes prior to production by using a broad range of tools that streamline your process planning workflows, automate nonvalue-added planning tasks and validate the best plan for making products.

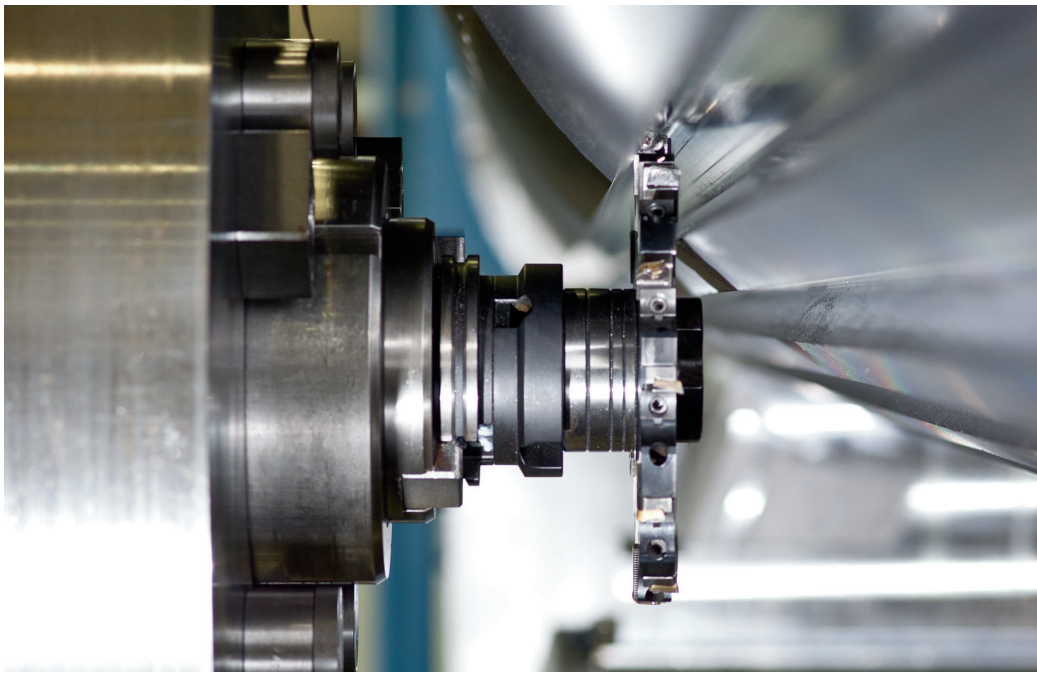
The digital twin of machinery

Building on next generation machine design is the digital twin of machinery. More than a 3D model, the digital twin of machinery provides a holistic virtual mockup of a machine. Multi-disciplinary analysis and closed-loop testing of the digital twin help machine builders identify the best parts, components, actuators, materials, processors and other assets to incorporate into their machine's design so that performance is optimized and customer requirements/global regulations/energy expectations are soundly met.

Since the digital twin of machinery is created within a virtual environment, machine builders can test an unlimited number of variations and machine configurations as customer requirements evolve, thus driving greater flexibility into the machine development process necessary for making hard and fast pivots as market expectations change. This virtual environment enables virtual commissioning to take place, helping engineers validate machines before a physical product is ever produced. Thus, virtual commissioning and the digital twin reduce the need for costly physical prototyping, as any issues in a machine's design can be found within the simulation and even remedied sooner, when the cost to change is low.

Furthermore, changes that occur within the digital twin automatically populate across any systems that are connected to the simulation software; for example, computer aided design (CAD) or computer aided electrical (CAE) software. This dynamic updating of design models ensures consistency across every level of the machine development process, helping avoid any time-consuming, costly errors from arising.

Machine configurations are also traceable, driving an additional layer of transparency and accountability into the design process, while simultaneously making it possible to restore any previous versions of a design that may be warranted for future iterations.



Additional capabilities encompassed by the digital twin of machinery include...

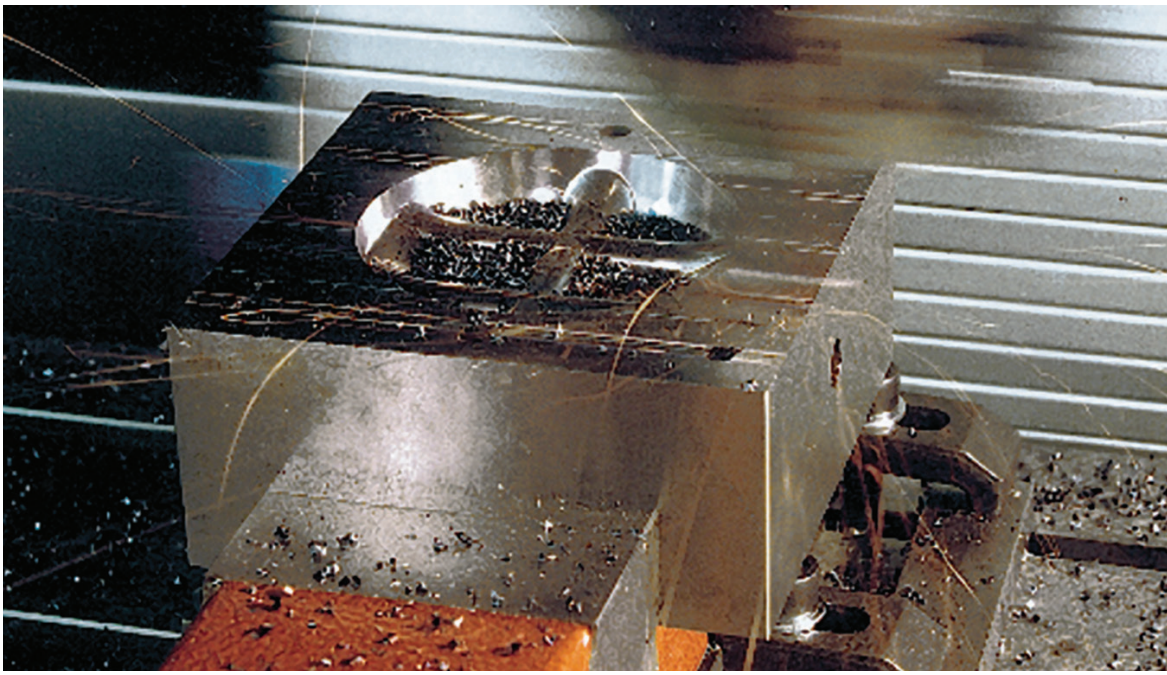
Product lifecycle management: Holistically develop your product from ideation through post-mortem by leveraging digital cloud tools that integrate requirements, suppliers, and disciplines (mechanical, electrical, electronic, software, etc) into a collaborative, transparent environment.

Application development platform: Connect disparate engineering systems under one cohesive umbrella with low-code development tools, where easy-to-use modules make it possible to create personalized applications that can automate operations or capture data.

Configuration lifecycle management: Utilize integrated machine configuration and product lifecycle management (PLM) capabilities to readily meet evolving customer demands and produce a greater quantity of product variations for the market.

Systems engineering: Accelerate and optimize the creation/delivery of complex machinery by using a closed-loop product development process that integrates disciplines and supports safety, reliability, materials and other program management tools.

Requirements and verification management: Achieve faster time to certification via a single, integrated environment that ensures all product verification events are integrated within the lifecycle, including simulation, modelling, analysis and physical tests driven by requirements, planning and execution.



Effective delivery of complex products

Helping realize the digital twin of machinery and next generation machine design is the effective delivery of complex projects. With this competency, machine builders can amalgamate their project, product, requirements and related information under one, cloud-based platform. This makes it easier to store, source, reference, use and update any machinery materials, helping streamline the product development process.

Moreover, this cloud-based platform makes it easier for machine builders to overcome labor scarcity or retainment issues because the cloud enables individuals to work at any time, from anywhere, meaning qualified employees all over the world can be hired. In essence, this work flexibility drives greater productivity, because someone will always be at work, helping create the best machinery.

And, when remote workers and physical workers come together under this cloud platform, greater teamwork can be fostered among the disciplines. Cross-collaboration means stronger communication and clear goal-setting, empowering workers to complete their jobs as they are all provided the same tools to use within the cloud. Some of these tools include real-time dashboards that populate each time a change is realized via the digital twin; order and production schedules that ensure machine builders are on time for projects; and budgeting sheets for keeping finances in order and driving revenue.

Additional capabilities encompassed by the effective delivery of complex projects include...

Product lifecycle management: Holistically develop your product from ideation through post-mortem by leveraging digital cloud tools that integrate requirements, suppliers, and disciplines (mechanical, electrical, electronic, software, etc) into a collaborative, transparent environment.

Program management: Win business and scale your commercial creations by implementing an program management system that integrates cost, schedule and technical requirements.

Best-in-class industry solutions

Machine builders don't need any solution – they need one that will help them integrate disciplines to optimize machine design; save resources through virtual testing; and accelerate time to market with project management dashboards and tools.

To this end, an instant-on, cloud-based platform built on decades of engineering expertise is key to mastering today's complexity into a key competitive advantage.

By working with the right, integrated tools, machine builders can monitor, trace and deliver on product lifecycle milestones; they can reconfigure machines with modular design tools; and they can deliver products faster via blended Engineer-to-Order and Configure-to-Order capabilities. All that's needed is mindset embracing digitalization – one small step for you, one giant leap forward for your business.

Conclusion

The industrial machinery landscape is changing. Industry 4.0 technologies are reshaping how companies respond to manufacturing challenges, creating new obstacles to overcome every day. To avoid falling in the face of adversary, machine builders must digitally innovate to stay on the cutting edge. This digital transformation begins and ends with a holistic, advanced machine engineering approach to building next generation machines, where integrated disciplines drive greater alignment and modular design necessary for delivering and scaling increasingly complex projects with multiple variants, all while meeting condensed timelines.

Supporting this creation of next generation machines are the digital twin of machinery and the effective delivery of complex projects, where virtual mockups and simulation tools enhance machine performance, while cloud-based tools empower remote and physical workers to collaborate, driving greater transparency and efficiency into the generation of advanced machines. Armed with these three core competencies, machine builders can deliver higher quality machines to market faster, expanding their profitability and keeping them in the driver's seat for the foreseeable future.

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.

18975-D59 5/23 A