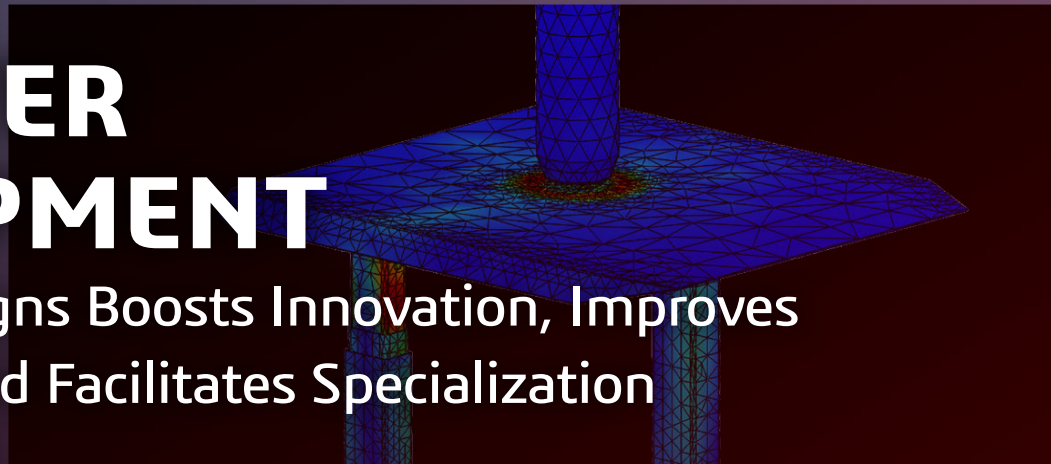
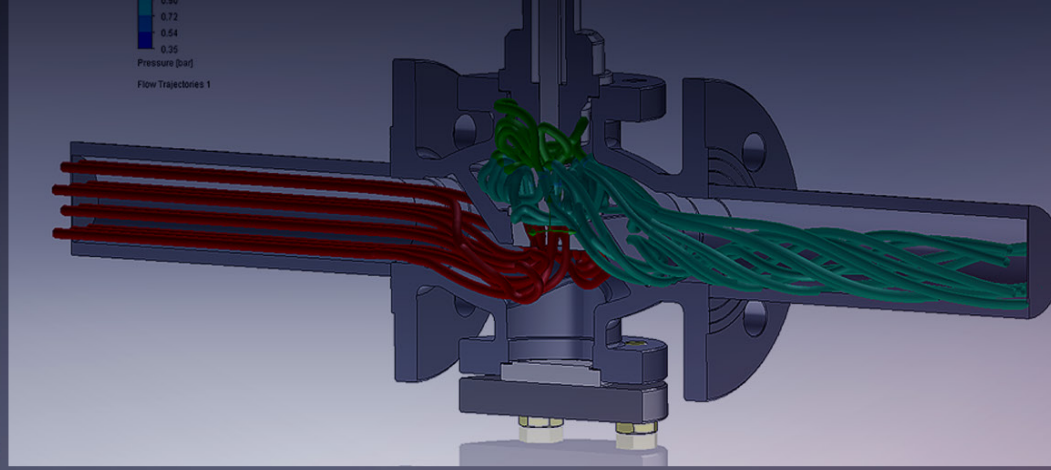


SOLIDWORKS

SIMULATING BETTER INDUSTRIAL EQUIPMENT

Validating Industrial Equipment Designs Boosts Innovation, Improves Quality, Accelerates Development, and Facilitates Specialization



ACCELERATING INNOVATIVE INDUSTRIAL EQUIPMENT DEVELOPMENT WITH SIMULATION

ADVANTAGES OF SIMULATION-DRIVEN DEVELOPMENT COMPARED TO PROTOTYPE-DRIVEN DEVELOPMENT

A CASE IN POINT: RESEMIN

INTEGRATED SIMULATION A "MUST" FOR INDUSTRIAL EQUIPMENT MANUFACTURERS

A CASE IN POINT: BUROCCO

IS STRUCTURAL SIMULATION ENOUGH, OR DO WE NEED MORE?

A CASE IN POINT: CAPRARI

CREATE INNOVATIVE PRODUCTS MORE QUICKLY WITH SOLIDWORKS SIMULATION SOLUTIONS

A CASE IN POINT: INFOCUS ENERGY SERVICES

A CASE IN POINT: PLASTIC COMPONENTS

CONCLUSION

Specialization has become the name of the game in today's rapidly segmenting industrial equipment market. Emerging technologies, innovative production methods, and new markets are contributing to this escalating specialization, with many manufacturers looking for faster, higher quality, better performing, more cost-effective, and more customized equipment designs to meet the challenges posed by changing manufacturing and industrial requirements. To remain competitive during this period of specialization, manufacturers of industrial equipment need to shorten development cycles and accelerate product time to market, while improving quality and increasing innovation. Industrial equipment manufacturers can realize additional time and cost savings—as well as higher quality, more innovative products—by utilizing simulation technologies—such as the wide range of integrated SOLIDWORKS® simulation solutions—to investigate, validate, and optimize industrial equipment designs and production processes. This ebook examines the challenges and opportunities facing companies in the industrial equipment market, and the ways that integrated simulation capabilities—like those embedded within the SOLIDWORKS 3D design system—can help manufacturers boost innovation, improve quality, control costs, and accelerate time to market.

ACCELERATING INNOVATIVE INDUSTRIAL EQUIPMENT DEVELOPMENT WITH SIMULATION

Overcoming unique product development challenges has long been a critical success factor for manufacturers of industrial equipment. It doesn't matter if a company develops engineered-to-order industrial equipment for a single customer, standardized products for many customers, or one-off equipment designs for specialized applications. Industrial equipment manufacturers have always needed to develop and produce intricately more complex electromechanical systems faster, better, and at less cost than their competitors in order to remain successful.

The specialization required to meet the new challenges associated with market segmentation simply adds to these challenges. Emerging technologies, innovative production methods, and new markets have divided what was once a single industrial equipment manufacturing market into seven distinct specialized markets, and this segmentation is accelerating. These industrial equipment market segments include:

- Industrial Robots, Machine Tools, and 3D Printers
- Specialized Manufacturing Machinery
- Heavy Mobile Machinery and Equipment
- Building Equipment
- Power and Fluidic Equipment
- Fabricated Metal and Plastic Products
- Tire Manufacturing



Segmentation of the industrial equipment market is accelerating for several reasons. Today's industrial equipment customers seek a new, improved industrial experience with greater expectations for quality and reliability. These customers expect higher levels of innovation and operational excellence, as well as increased use of new technologies and intelligent, interconnected systems. They want compliance with safety standards to be a given, and their suppliers to provide customization value as a mass production deliverable. They want smart approaches to production that enable them to deliver their products to market more quickly and at competitive prices. They want their manufacturing and production to be data-driven so they can remain in step with the greater data economy and use big data and analytics to improve profitability. Perhaps most importantly, today's industrial equipment customers seek to invent and capitalize on new markets, and want their suppliers to take a product-as-a-service approach to development.

Developers of industrial equipment can capitalize on the growing demands of today's more demanding customers and more quickly respond to the accelerating challenges of market segmentation by incorporating simulation technology, also known as finite element analysis (FEA), into their product development processes. Because simulation tools can minimize costly, time-consuming physical prototyping, manufacturers in the industrial equipment market can leverage simulation technology to accelerate time to market while simultaneously increasing innovation and improving quality.

In addition to saving time and money, leveraging integrated simulation solutions like the ones offered by SOLIDWORKS frequently provides product developers with the insights needed to create the innovative approaches that lead to breakthrough products. Simulation can also support more consistent levels of quality, a more agile response to emerging customer needs, and better solutions for optimizing manufacturing processes, resulting in more cost-effective production through reduced cycle times.



ACCELERATING INNOVATIVE INDUSTRIAL EQUIPMENT DEVELOPMENT WITH SIMULATION

ADVANTAGES OF SIMULATION-DRIVEN DEVELOPMENT COMPARED TO PROTOTYPE-DRIVEN DEVELOPMENT

A CASE IN POINT: RESEMIN

INTEGRATED SIMULATION A "MUST" FOR INDUSTRIAL EQUIPMENT MANUFACTURERS

A CASE IN POINT: BUROCCO

IS STRUCTURAL SIMULATION ENOUGH, OR DO WE NEED MORE?

A CASE IN POINT: CAPRARI

CREATE INNOVATIVE PRODUCTS MORE QUICKLY WITH SOLIDWORKS SIMULATION SOLUTIONS

A CASE IN POINT: INFOCUS ENERGY SERVICES

A CASE IN POINT: PLASTIC COMPONENTS

CONCLUSION

ADVANTAGES OF SIMULATION-DRIVEN DEVELOPMENT WHEN COMPARED TO PROTOTYPE-DRIVEN DEVELOPMENT

SIMULATION-DRIVEN DEVELOPMENT

- Minimizes repetitive rounds of physical prototyping.
- Saves time and money.
- Validates design performance.
- Mitigates design for manufacturability risk.
- Identifies potential field failure or warranty issues.
- Reveals innovative approaches.
- Improves quality.
- Optimizes design performance.
- Validates production processes.
- Shortens time to market.

PROTOTYPE-DRIVEN DEVELOPMENT

- Relies on repetitive rounds of costly physical prototyping.
- Takes longer, costs more for design validation.
- May or may not validate design performance.
- May or may not mitigate design for manufacturability risk.
- May or may not reveal potential field failure or warranty issues.
- May or may not reveal innovative approaches.
- May or may not improve quality.
- Does not provide a design optimization option.
- Can require additional production process prototyping.
- Extends time to market.

ACCELERATING INNOVATIVE INDUSTRIAL EQUIPMENT DEVELOPMENT WITH SIMULATION

ADVANTAGES OF SIMULATION-DRIVEN DEVELOPMENT COMPARED TO PROTOTYPE-DRIVEN DEVELOPMENT

A CASE IN POINT: RESEMIN

INTEGRATED SIMULATION A "MUST" FOR INDUSTRIAL EQUIPMENT MANUFACTURERS

A CASE IN POINT: BUROCCO

IS STRUCTURAL SIMULATION ENOUGH, OR DO WE NEED MORE?

A CASE IN POINT: CAPRARI

CREATE INNOVATIVE PRODUCTS MORE QUICKLY WITH SOLIDWORKS SIMULATION SOLUTIONS

A CASE IN POINT: INFOCUS ENERGY SERVICES

A CASE IN POINT: PLASTIC COMPONENTS

CONCLUSION

... A CASE IN POINT

BOOSTING DRILLING MACHINERY THROUGHPUT, REDUCING DELIVERY TIMES WITH SOLIDWORKS SIMULATION PREMIUM

Resemin is a top international manufacturer of underground drilling machinery and related equipment, producing some of the leading mining equipment brands in the world. Founded in 1989, the company has grown into an international leader by focusing on quality, safety, and reliability, and strict adherence to international standards under its ISO 9001:2000 certification.

According to Engineering Manager Fernando Díaz, quickly creating 3D design geometries and the ability to easily obtain finite element analysis (FEA) results, which help reduce development time and prototyping requirements while enabling the company to meet ISO 3449:2005 falling-object protective structures (FOPS) performance criteria, became critically important for the manufacturer's competitiveness.

Although Resemin engineers initially used ANSYS® software to conduct FEA studies on SOLIDWORKS models, they saw the potential for realizing greater productivity gains by leveraging integrated SOLIDWORKS Simulation Premium software, which Resemin migrated to in 2011, to conduct the complex nonlinear analyses that are required to comply with the FOPS standard. With SOLIDWORKS Simulation Premium software, Resemin not only can conduct the complex nonlinear contact with plasticity analyses required to validate that its designs will protect operators from falling rocks, it also can perform these studies more quickly, resulting in a 70 percent reduction in prototyping.

"SOLIDWORKS Simulation Premium software provides accurate results and produces solutions much faster than the ANSYS FEA software that we used in the past," Díaz explains. "A nonlinear contact with plasticity analysis used to take two days to solve with ANSYS. With SOLIDWORKS Simulation Premium software, we're solving the same type of problem in a couple hours. This saves a lot of time in validating our designs prior to prototyping."

Using SOLIDWORKS simulation-driven product development solutions, Resemin has cut its machine delivery times in half, increased throughput from two to 60 machines annually, shortened analysis run times from two days to two hours, and reduced prototyping by 70 percent.



READ THE WHOLE STORY

To read the full Resemin story, click [here](#).



ACCELERATING
INNOVATIVE INDUSTRIAL
EQUIPMENT DEVELOPMENT
WITH SIMULATION

ADVANTAGES OF
SIMULATION-DRIVEN
DEVELOPMENT COMPARED
TO PROTOTYPE-DRIVEN
DEVELOPMENT

A CASE IN POINT:
RESEMIN

INTEGRATED SIMULATION
A "MUST" FOR
INDUSTRIAL EQUIPMENT
MANUFACTURERS

A CASE IN POINT:
BUROCCO

IS STRUCTURAL
SIMULATION ENOUGH,
OR DO WE NEED MORE?

A CASE IN POINT:
CAPRARI

CREATE INNOVATIVE
PRODUCTS MORE QUICKLY
WITH SOLIDWORKS
SIMULATION SOLUTIONS

A CASE IN POINT:
INFOCUS ENERGY SERVICES

A CASE IN POINT:
PLASTIC COMPONENTS

CONCLUSION

INTEGRATED SIMULATION A “MUST” FOR INDUSTRIAL EQUIPMENT MANUFACTURERS

Facing mounting pressures to develop more specialized, more innovative, and higher quality industrial equipment more quickly and cost-effectively than ever, industrial equipment manufacturers are steadily turning to integrated simulation tools like SOLIDWORKS to gain and maintain a competitive edge. Simply put, product developers need more information about design behavior and performance—information that’s readily available with integrated simulation tools—early in the development process in order to deliver better, more complex products more quickly and affordably. Because manufacturers need to develop more specialized products in less time, integrated simulation is becoming a “must-have” capability for understanding design behavior and validating design performance while avoiding the time delays associated with numerous rounds of physical prototyping.

Saves Time

While simulation tools cannot replace a final physical test to validate a product, they can dramatically reduce the number of prototypes and rounds of physical prototyping required, often bringing the number of physical tests required down to one and saving substantial amounts of time. As products become more innovative, specialized, and complex, the need to understand design behavior and performance becomes more challenging. Because developing more complex products has historically required more design iterations and rounds of physical prototyping to fully understand design behavior and validate product performance and safety, product developers can use simulation tools and virtual prototyping to complete many design iterations in less time. Instead of spending time and money to build and test a physical prototype after each iteration, they can simply run a virtual simulation and synthesize the results into the next iteration.



ACCELERATING INNOVATIVE INDUSTRIAL EQUIPMENT DEVELOPMENT WITH SIMULATION

ADVANTAGES OF SIMULATION-DRIVEN DEVELOPMENT COMPARED TO PROTOTYPE-DRIVEN DEVELOPMENT

A CASE IN POINT: RESEMIN

INTEGRATED SIMULATION A “MUST” FOR INDUSTRIAL EQUIPMENT MANUFACTURERS

A CASE IN POINT: BUROCCO

IS STRUCTURAL SIMULATION ENOUGH, OR DO WE NEED MORE?

A CASE IN POINT: CAPRARI

CREATE INNOVATIVE PRODUCTS MORE QUICKLY WITH SOLIDWORKS SIMULATION SOLUTIONS

A CASE IN POINT: INFOCUS ENERGY SERVICES

A CASE IN POINT: PLASTIC COMPONENTS

CONCLUSION



Saves Money

Physical prototyping is costly—especially when developing large pieces of industrial equipment—and the more rounds of prototyping that are required to develop a product, the greater the cost. By replacing many possible rounds of physical prototyping, integrated simulation capabilities can help manufacturers of industrial equipment save money. Moreover, these cost reductions go beyond the obvious savings of reduced physical prototyping. When design performance is simulated repeatedly, designers and engineers gain a better understanding of design behavior than is possible solely through physical prototyping, resulting in fewer engineering change orders (ECOs) and reduced costs related to returns, warranty claims, and field failures. With injection-molding simulation capabilities, manufacturers can also eliminate the cost of prototype tooling. Integrated simulation supports both rapid and cost-effective product development.

Improves Quality, Increases Innovation

For industrial equipment to be successful in today's rapidly segmenting market, not only must it be innovative, specialized, and provide more features or better performance than existing approaches, it must also be reliable, require less maintenance, and last longer before needing to be replaced. In today's industrial equipment market, the quality, performance, and life span of a piece of industrial equipment are as important as the specialized function that it fulfills. Customers no longer have the patience or tolerance for shoddy quality or industrial equipment that requires burdensome maintenance.

With simulation capabilities, industrial equipment manufacturers can deliver both consistent quality and increased innovation. A consistent level of product quality is the outcome of the numerous design performance simulations and refinements made during design iterations with simulation tools. Because a product is repeatedly tested in software and then validated through a physical test, it will generally be of higher quality and include more improvements than those developed through the build-and-break-and-redesign paradigm. Innovation typically begins with an idea. However, refining that initial idea into a usable product or innovative feature is best achieved using integrated simulation tools. With the ability to perform design-and-simulation iterations quickly, designers and engineers can use analysis results to refine innovative designs or even discover completely new approaches.

**ACCELERATING
INNOVATIVE INDUSTRIAL
EQUIPMENT DEVELOPMENT
WITH SIMULATION**

**ADVANTAGES OF
SIMULATION-DRIVEN
DEVELOPMENT COMPARED
TO PROTOTYPE-DRIVEN
DEVELOPMENT**

**A CASE IN POINT:
RESEMIN**

**INTEGRATED SIMULATION
A "MUST" FOR
INDUSTRIAL EQUIPMENT
MANUFACTURERS**

**A CASE IN POINT:
BUROCCO**

**IS STRUCTURAL
SIMULATION ENOUGH,
OR DO WE NEED MORE?**

**A CASE IN POINT:
CAPRARI**

**CREATE INNOVATIVE
PRODUCTS MORE QUICKLY
WITH SOLIDWORKS
SIMULATION SOLUTIONS**

**A CASE IN POINT:
INFOCUS ENERGY SERVICES**

**A CASE IN POINT:
PLASTIC COMPONENTS**

CONCLUSION

... A CASE IN POINT

OPTIMIZING INDUSTRIAL VALVE DESIGN PERFORMANCE WITH SOLIDWORKS FLOW SIMULATION

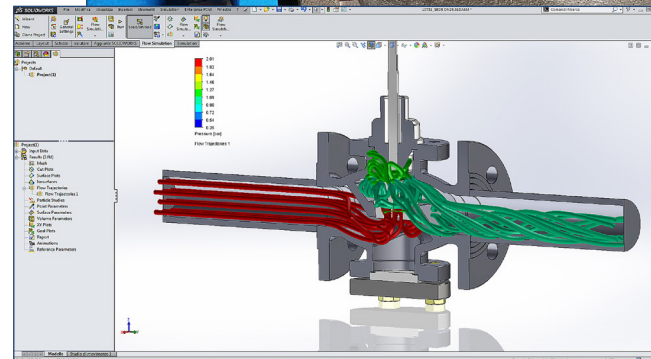
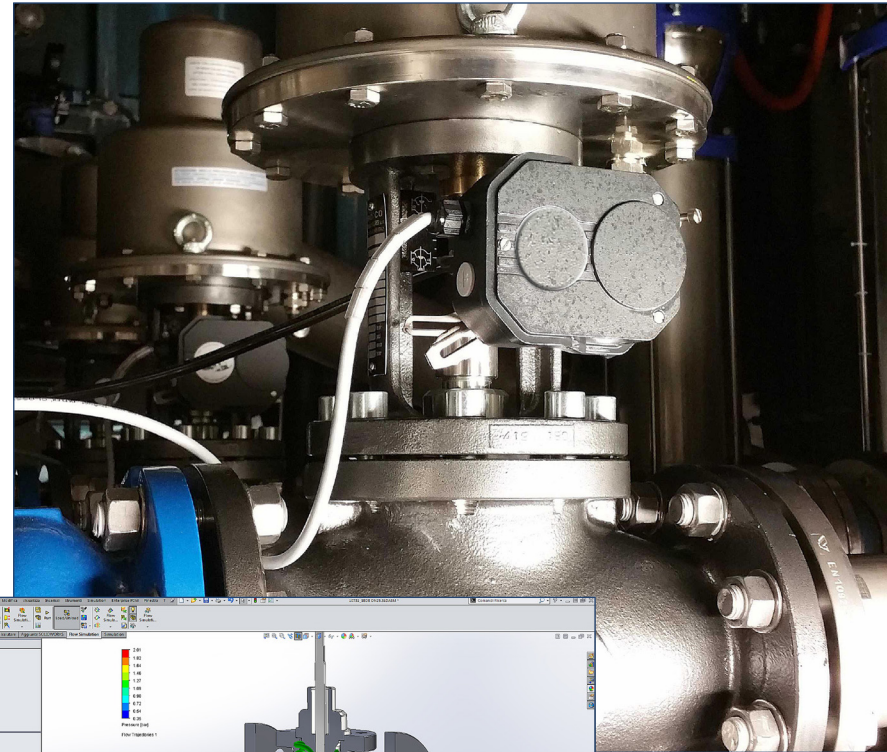
Burocco Industrial Valves has designed and manufactured stainless steel industrial valves for regulating, shutting off, and turning on the flow of water and other fluids since 1954. The company's research and development effort has resulted in products of increasing quality, sophistication, and innovation.

In keeping with the company's quality commitment, Burocco engineers increasingly need to understand fluid dynamics within new valve designs without incurring the delays and expense of iterative physical prototyping. "We realized that we needed a fluid-flow simulation solution because the [Autodesk] Inventor® and Fusion 360® applications that we had been using were unable to do the types of flow simulations that we needed to accelerate development and production," recalls Sales Manager Paolo Palestro. "Our principal need was the ability to accurately calculate the flow of a fluid inside our valves."

After investigating available solutions, Burocco decided to standardize on the SOLIDWORKS 3D design environment, implementing SOLIDWORKS CAD, Flow Simulation, Product Data Management (PDM), and technical communication software. "For us, the value of SOLIDWORKS is in the integrated applications," Palestro stresses. "We view CAD systems as very similar, but the SOLIDWORKS platform gives us access to the integrated tools that we truly need."

Since implementing SOLIDWORKS CAD and SOLIDWORKS Flow Simulation CFD analysis software, Burocco engineers are able to identify and resolve areas of turbulence within the fluid flows that its valves regulate—turbulence that can degrade valve performance. "We always have to keep in mind the possibility that the valve geometry can create turbulence, which makes the flow 'dirty,'" Palestro notes.

"Using SOLIDWORKS and SOLIDWORKS Flow Simulation, we not only come to understand where areas of turbulence damage the clean flows that we need, but also determine how changes to the valve design can smooth the flow, reducing prototyping and machining costs," Palestro adds. "In just a few minutes, our engineers can use SOLIDWORKS Flow Simulation to calculate everything they need with an accuracy of 98 percent. This enables us to improve product performance."



The move to SOLIDWORKS CAD, Simulation, and additional integrated solutions enabled Burocco to shorten its design cycles by 25 percent, predict fluid flows with 98 percent accuracy, increase design reuse by 50 percent, and eliminate turbulence within valves without physical prototyping.

READ THE WHOLE STORY

To read the full Burocco story, click [here](#).

BUROCCO
INDUSTRIAL VALVES srl

ACCELERATING
INNOVATIVE INDUSTRIAL
EQUIPMENT DEVELOPMENT
WITH SIMULATION

ADVANTAGES OF
SIMULATION-DRIVEN
DEVELOPMENT COMPARED
TO PROTOTYPE-DRIVEN
DEVELOPMENT

A CASE IN POINT:
RESEMIN

INTEGRATED SIMULATION
A "MUST" FOR
INDUSTRIAL EQUIPMENT
MANUFACTURERS

A CASE IN POINT:
BUROCCO

IS STRUCTURAL
SIMULATION ENOUGH,
OR DO WE NEED MORE?

A CASE IN POINT:
CAPRARI

CREATE INNOVATIVE
PRODUCTS MORE QUICKLY
WITH SOLIDWORKS
SIMULATION SOLUTIONS

A CASE IN POINT:
INFOCUS ENERGY SERVICES

A CASE IN POINT:
PLASTIC COMPONENTS

CONCLUSION

IS STRUCTURAL SIMULATION ENOUGH, OR DO WE NEED MORE?

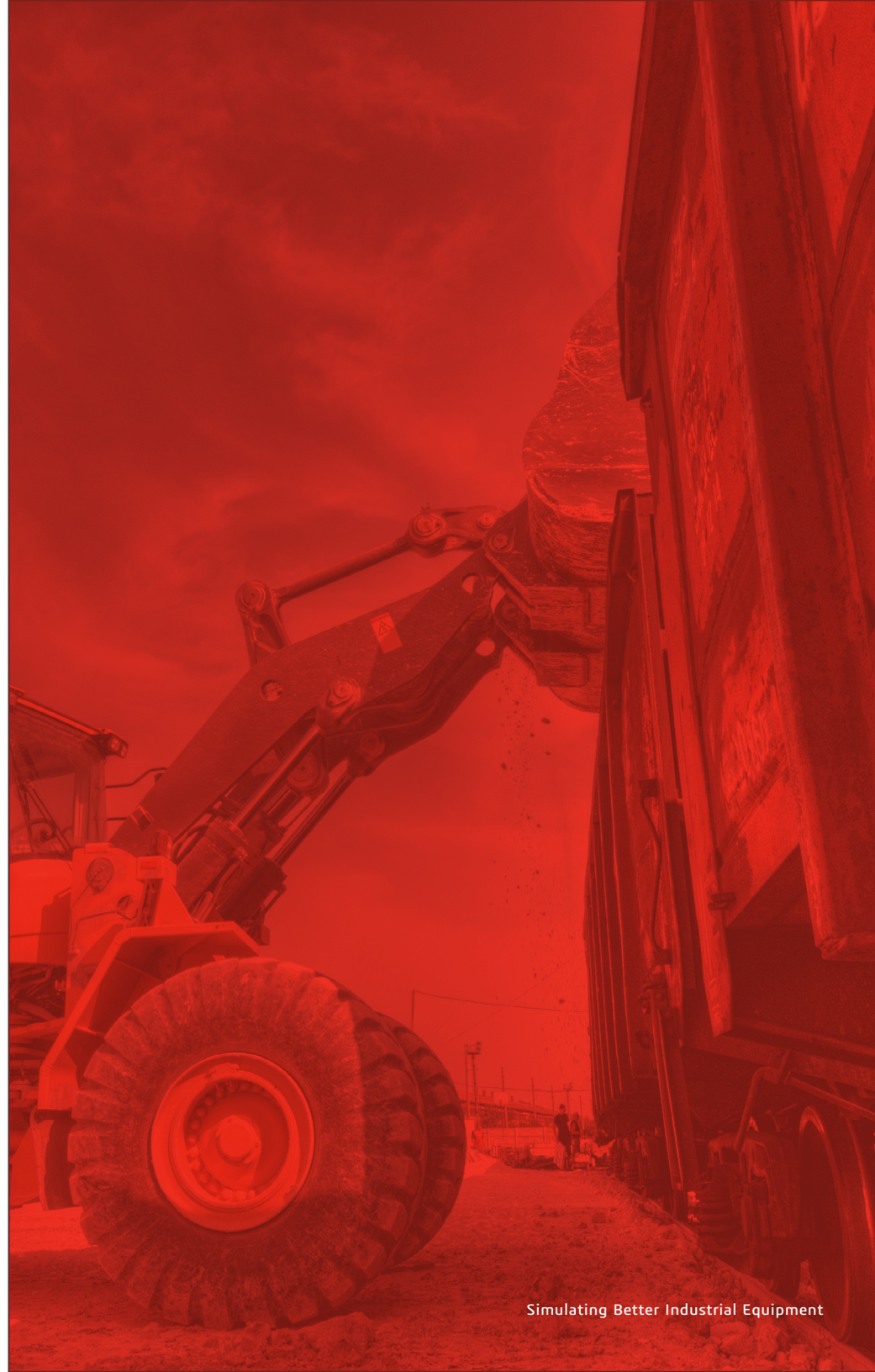
Most designers and engineers associate simulation and analysis with structural analysis, also called finite element analysis (FEA). Structural analysis tools are the most widely used type of simulation for understanding the stress, deflection and deformation, vibration, fatigue, and buckling responses on a part or assembly design under load. These tools can help industrial equipment product developers answer important questions like: Will it break? Will it bend? Will it deform? Is it stiff enough? When will it wear out? Answers to these questions can help facilitate development, but there are many other types of integrated simulation tools that can help these manufacturers accelerate time to market while improving quality and boosting innovation.

Structural Analysis

To identify areas of high stress that could result in component or assembly failure, industrial equipment product developers need at minimum the ability to conduct linear static stress analyses. By simulating a design's structural response to the loads and boundary conditions of its operating environment, designers and engineers can pinpoint areas of high stress, use simulation tools to rework the design to bring stresses within allowable levels, verify the appropriate factor of safety, or reduce weight or material usage, while maintaining performance.

In addition to linear static stress simulation capabilities, SOLIDWORKS provides integrated simulation tools for understanding the natural frequencies of a component design. This is another valuable simulation capability for designers because such studies show whether a design will deflect, or be displaced, too much or too little. On some designs, controlled deflection is a design requirement, so the part cannot be too stiff. On other designs, the goal may be to not have the component deflect much at all, making stiffness an important objective. In either case, the ability to quickly simulate deflection and displacement becomes a valuable tool.

SOLIDWORKS Simulation also has solutions for predicting how long a particular product will last based on usage. Extending a product's lifespan—or ensuring that the product will continue to perform past its warranty period—requires an understanding of when the part will wear out. With integrated SOLIDWORKS Simulation fatigue analysis tools, designers and engineers can project the number of cycles, or use over time, before a specific component will wear out and fail. With this valuable information in hand, they can make design modifications to either maintain or extend the life of a part.



**ACCELERATING
INNOVATIVE INDUSTRIAL
EQUIPMENT DEVELOPMENT
WITH SIMULATION**

**ADVANTAGES OF
SIMULATION-DRIVEN
DEVELOPMENT COMPARED
TO PROTOTYPE-DRIVEN
DEVELOPMENT**

**A CASE IN POINT:
RESEMIN**

**INTEGRATED SIMULATION
A "MUST" FOR
INDUSTRIAL EQUIPMENT
MANUFACTURERS**

**A CASE IN POINT:
BUROCCO**

**IS STRUCTURAL
SIMULATION ENOUGH,
OR DO WE NEED MORE?**

**A CASE IN POINT:
CAPRARI**

**CREATE INNOVATIVE
PRODUCTS MORE QUICKLY
WITH SOLIDWORKS
SIMULATION SOLUTIONS**

**A CASE IN POINT:
INFOCUS ENERGY SERVICES**

**A CASE IN POINT:
PLASTIC COMPONENTS**

CONCLUSION

Motion and Kinematics Analysis

Although not all mechanical assemblies move, many assemblies, such as mechanisms, move a great deal. Using SOLIDWORKS kinematics and motion simulation tools, designers can actually see how their assemblies will move, as well as generate important dynamic loading information for the design, which improves the accuracy of both assembly and individual component structural simulations. By simulating assembly movement, designers and engineers can gain a better appreciation for the dynamics of the entire assembly and quickly pinpoint areas that need improvement.

Nonlinear Analysis

Although linear analysis tools can help solve many types of structural problems, other types of simulations—especially with complex designs—require nonlinear analysis tools to obtain an accurate solution. Nonlinear structural analysis problems, which are distinguished from linear problems because the response is not proportional to the loads and boundary conditions, generally fall within three categories: nonlinear materials, nonlinear geometries, and nonlinear interactions between parts, or contact nonlinearities. Some nonlinear problems can even involve all three types, as well as nonlinear loads/boundary conditions and nonlinear dynamics/vibration. Other nonlinear problems involve highly nonlinear contact between parts or between the product and another object, such as drop tests. Nonlinear analysis tools are available in SOLIDWORKS Simulation Premium software and the cloud-based SIMULIAworks system.

Topology Optimization

Another type of integrated structural simulation that is particularly useful in helping designers and engineers develop innovative products is topology optimization. A topology study explores design iterations of component geometry to satisfy a given optimization goal—such as minimizing mass, minimizing maximum displacement, or balancing the weight-to-stiffness ratio—based on specific loads and geometric constraints, including those imposed by the manufacturing process used. Topology optimization is a valuable tool for generating innovative and organic design concepts, establishing starting points for the design team, or generating ideas for refining an existing design.

Thermal Analysis

In addition to simulating the impact of structural loads on a design, analysts need thermal simulation capabilities to understand how temperature and heat transfer effects influence structural performance. Such analyses provide the insights necessary for determining whether a heat sink or cooling system is indicated. Then, analysts can use the same thermal analysis tools to validate that the heat sink or cooling system transfers away enough heat to ensure optimal performance.

Understanding how heat transfer impacts design performance is important for an increasing number of products for safety and performance reasons. Many materials have temperature-dependent properties, and integrated SOLIDWORKS analysis tools can simulate different types of heat transfer—including conduction, convection, or radiation—and calculate heat transfer within and between components in a design and its environment. These tools can simulate transient and steady-state effects. Thermal problems can be solved using either structural or fluid-flow analysis. In a thermal structural analysis, the effect of moving air or liquid becomes a load or boundary condition. In a fluid-flow analysis, the software calculates the thermal effects of moving fluids, whether they are liquids or gases.

Multiphysics Analysis

While a large portion of simulation problems examine a particular type of physical phenomena—such as structural mechanics, structural dynamics, fluid dynamics, and thermal analyses—many situations require a combined multiphysics approach. Examples of multiphysics simulations include thermal stress or thermo-mechanical (thermal/structural), fluid structural interaction (flow/structural), fluid flow with heat transfer (flow/thermal), and fluid structural interaction with heat transfer (flow/thermal/structural). The combination of SOLIDWORKS Simulation and SOLIDWORKS Flow Simulation provides a powerful, integrated suite of tools for analyzing many possible combinations of physical phenomena, enabling designers and engineers to gain a definitive understanding of how various physical phenomena affect the way a design will function and perform.

Fluid-Flow Analysis

Product developers in the industrial equipment market can use fluid-flow analysis, also known as computational fluid dynamics (CFD) analysis, to better understand how the behavior and dynamics of fluids—either liquids or gases—affect design performance. Although initially used primarily as an alternative to expensive wind-tunnel testing for improving the aerodynamics of aircraft and automobiles, SOLIDWORKS Flow Simulation CFD analysis technology is now increasingly used to evaluate other flow-related issues, such as validating sufficient cooling of electronics; maximizing the performance of heating, ventilation, and air conditioning (HVAC) systems; optimizing the flow of molten plastics within molds; and refining other flow-based manufacturing and piping processes.

Electronics Cooling Analysis

With the SOLIDWORKS Flow Simulation Electronics Cooling Module, designers and engineers are able to more easily optimize airflow and cooling in electronic designs. This powerful tool enables product developers to improve airflow and cooling, by moving components or creating air baffles and ducts; validate overall thermal performance, by studying heat-up/cool-down cycles and maximum temperature under load; and pick the best heat sink, by assessing the impact of airflow cooling over the printed circuit board (PCB). Understanding and isolating the thermal characteristics of the PCB allows for evaluation of component placement and the use of heat pipes, thermal pads, and interface materials, as well as selection and placement of the ideal fan arrangement, which can have a dramatic impact on the overall thermal performance of a design.

Plastics Injection-Molding Analysis

Plastics injection-molding analysis software allows product developers to simulate the injection-molding production process for plastic parts to optimize tooling development. This solution enables designers and engineers to evaluate the manufacturability of injection-molded parts during the early stages of design. By simulating the mold injection process, product developers will understand how the mold will fill, whether there are any air traps or voids, and where parting and weld lines will be. With these tools, product developers can consistently deliver designs that don't require manufacturing modifications, reducing the need to prototype tooling.



ACCELERATING INNOVATIVE INDUSTRIAL EQUIPMENT DEVELOPMENT WITH SIMULATION

ADVANTAGES OF SIMULATION-DRIVEN DEVELOPMENT COMPARED TO PROTOTYPE-DRIVEN DEVELOPMENT

A CASE IN POINT: RESEMIN

INTEGRATED SIMULATION A "MUST" FOR INDUSTRIAL EQUIPMENT MANUFACTURERS

A CASE IN POINT: BUROCCO

IS STRUCTURAL SIMULATION ENOUGH, OR DO WE NEED MORE?

A CASE IN POINT: CAPRARI

CREATE INNOVATIVE PRODUCTS MORE QUICKLY WITH SOLIDWORKS SIMULATION SOLUTIONS

A CASE IN POINT: INFOCUS ENERGY SERVICES

A CASE IN POINT: PLASTIC COMPONENTS

CONCLUSION

... A CASE IN POINT

ACHIEVING INNOVATION IN INDUSTRIAL PUMP DESIGN WITH SOLIDWORKS SIMULATION

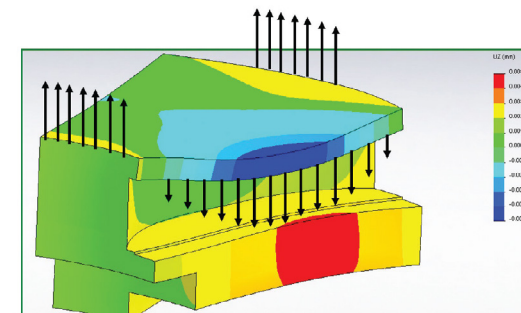
The Caprari Group is a leading international manufacturer of centrifugal pumps, electric pumps, and submersible motors for civil and industrial water and wastewater pumping applications. Until 1998, Caprari utilized 2D design tools. However, increasing competition and growing market demand for better measuring and dispensing pump performance prompted the company to evaluate 3D design as a means for streamlining its processes, improving pump performance, and boosting innovation, according to Research & Design Manager Antonio Gambigliani.

“We needed a better way to advance the science of pump design,” Gambigliani explains. “Working in 2D, it was difficult to accurately produce parts from 2D designs, and then prototype and test them efficiently and cost-effectively. For example, the impeller blades on our pumps are complex surfaces, and we need to be able to design and manufacture them with a high degree of precision. We also believed that 3D design would provide opportunities for using finite element analysis [FEA] and computational fluid dynamics [CFD] simulation technologies to save time and money during prototyping and testing.”

After evaluating leading 3D CAD systems, including Solid Edge®, Pro/ENGINEER®, think3®, and SOLIDWORKS, Caprari decided to standardize on SOLIDWORKS, implementing SOLIDWORKS design, SOLIDWORKS Simulation Premium analysis, SOLIDWORKS Flow Simulation (CFD) analysis, and SOLIDWORKS Inspection Professional software solutions.

With SOLIDWORKS solutions, Caprari has achieved its goals of improving product performance and introducing industry innovations. For example, the company introduced a re-engineered version of the fluid-film thrust bearing for submersible motors, securing a new patent by advancing technology first developed more than a century ago. Specifically, Caprari used SOLIDWORKS design and analysis tools to simplify and enhance the kinematics of fluid-film thrust bearings first developed by George Michell and Albert Kingsbury, resulting in a performance boost of 300 percent.

“We used SOLIDWORKS Simulation Premium tools to analyze and optimize our updated design,” Gambigliani says. “By using different materials—rubber, brass, graphite, and steel—and investigating deformation under stress, we were able to



optimize the design to use a fixed box and shoes mounted on rubber. This simplification improved performance because it reverses the deformation elasticity skid to increase and retain the interposed lubricant film and permits the rubber of the shoe to oscillate in all directions.”

By implementing SOLIDWORKS design, simulation, flow simulation, and inspection solutions, Caprari increased fluid-film thrust-bearing performance in submersible pumps by 300 percent, cut prototyping and testing time by 66 percent, reduced prototyping and testing costs by 99 percent, and decreased scrap and rework by 15 to 25 percent.

READ THE WHOLE STORY

To read the full Caprari story, click [here](#).



ACCELERATING
INNOVATIVE INDUSTRIAL
EQUIPMENT DEVELOPMENT
WITH SIMULATION

ADVANTAGES OF
SIMULATION-DRIVEN
DEVELOPMENT COMPARED
TO PROTOTYPE-DRIVEN
DEVELOPMENT

A CASE IN POINT:
RESEMIN

INTEGRATED SIMULATION
A “MUST” FOR
INDUSTRIAL EQUIPMENT
MANUFACTURERS

A CASE IN POINT:
BUROCCO

IS STRUCTURAL
SIMULATION ENOUGH,
OR DO WE NEED MORE?

A CASE IN POINT:
CAPRARI

CREATE INNOVATIVE
PRODUCTS MORE QUICKLY
WITH SOLIDWORKS
SIMULATION SOLUTIONS

A CASE IN POINT:
INFOCUS ENERGY SERVICES

A CASE IN POINT:
PLASTIC COMPONENTS

CONCLUSION

CREATE INNOVATIVE PRODUCTS MORE QUICKLY WITH SOLIDWORKS SIMULATION SOLUTIONS

Manufacturers of industrial equipment can more quickly respond to changing market demands by using fully integrated simulation tools—like those that operate inside the SOLIDWORKS product development platform. With SOLIDWORKS design and integrated simulation capabilities, industrial equipment and tooling manufacturers can realize the agility and flexibility required to develop more innovative, high-quality products more quickly and affordably than the competition. To find out more about each solution, click on the hyperlinks at right.

Structural Analysis

SOLIDWORKS Simulation Standard

- Linear Static Analysis
- Assembly Analysis
- Motion and Kinematics Analysis
- Fatigue Studies

SOLIDWORKS Simulation Professional

- Linear Static Analysis
- Assembly Analysis
- Motion Analysis
- Fatigue Studies
- Thermal Analysis
- Frequency Studies
- Buckling Studies
- Pressure Vessel Studies
- Topology Studies

SOLIDWORKS Simulation Premium

- Linear Static Analysis
- Assembly Analysis
- Motion Analysis
- Fatigue Studies
- Thermal Analysis
- Frequency Studies
- Buckling Studies
- Pressure Vessel Studies
- Topology Studies
- Linear Dynamic Studies
- Nonlinear Analysis

SIMULIAworks Linear and Nonlinear Analysis in the Cloud

Thermal Analysis

SOLIDWORKS Simulation Professional

SOLIDWORKS Simulation Premium

SIMULIAworks Linear and Nonlinear Analysis in the Cloud

Multiphysics Analysis

SOLIDWORKS Simulation Premium

SIMULIAworks Linear and Nonlinear Analysis in the Cloud

Fluid-Flow Analysis

SOLIDWORKS Flow Simulation

SOLIDWORKS Flow Simulation Electronics Cooling Module

Plastics Injection Molding Analysis

SOLIDWORKS Plastics

SOLIDWORKS Plastics Professional

SOLIDWORKS Plastics Premium

ACCELERATING INNOVATIVE INDUSTRIAL EQUIPMENT DEVELOPMENT WITH SIMULATION

ADVANTAGES OF SIMULATION-DRIVEN DEVELOPMENT COMPARED TO PROTOTYPE-DRIVEN DEVELOPMENT

A CASE IN POINT: RESEMIN

INTEGRATED SIMULATION A "MUST" FOR INDUSTRIAL EQUIPMENT MANUFACTURERS

A CASE IN POINT: BUROCCO

IS STRUCTURAL SIMULATION ENOUGH, OR DO WE NEED MORE?

A CASE IN POINT: CAPRARI

CREATE INNOVATIVE PRODUCTS MORE QUICKLY WITH SOLIDWORKS SIMULATION SOLUTIONS

A CASE IN POINT: INFOCUS ENERGY SERVICES

A CASE IN POINT: PLASTIC COMPONENTS

CONCLUSION

... A CASE IN POINT

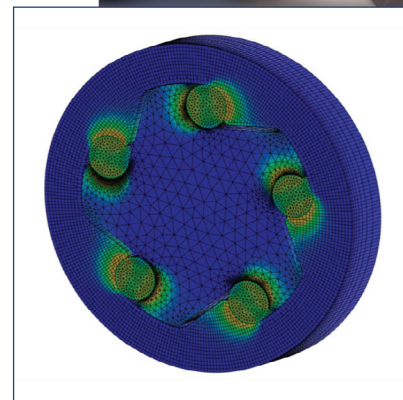
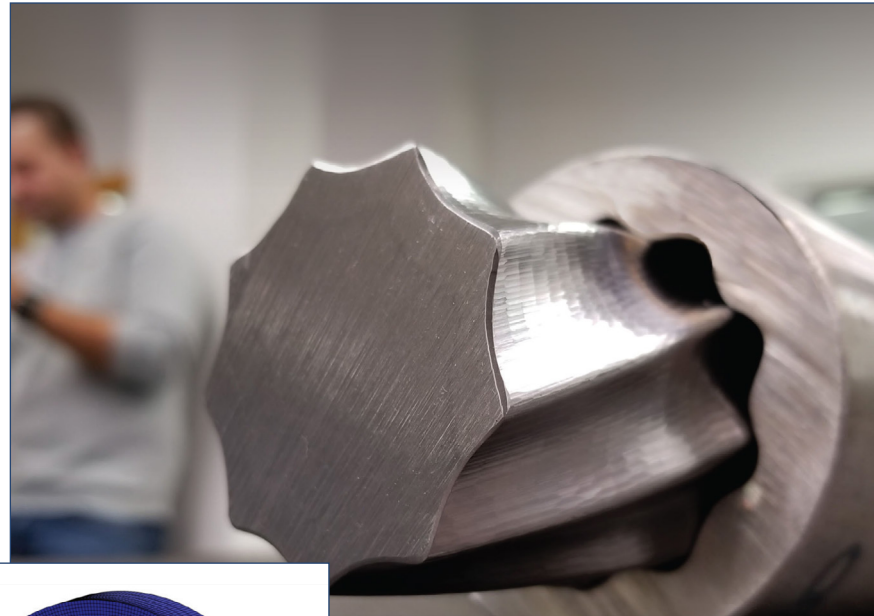
DEVELOPING DOWNHOLE OIL AND GAS DRILLING PRODUCTS FASTER WITH SIMULIAWORKS

InFocus Energy Services, Inc. is an innovative Canadian company specializing in the development of solution-driven downhole products for the oil and gas industry. According to Founder/Director Allan Pearson, InFocus has utilized SOLIDWORKS tools from the start because the integrated solutions provide the power, agility, and flexibility that the company needs to consistently develop innovative products. "SOLIDWORKS is the core of our engineering group," Pearson notes. "It's the basis for everything we do: modeling, simulation, flow analysis, renderings. We rarely have to rely on other products."

"We've used SOLIDWORKS Simulation Premium for certain types of analysis, but our work increasingly involves not only geometric and material nonlinearities but also complex contact problems," notes Mechanical Engineer/Simulation Specialist Peter Kjellbotn. "We needed more simulation power, as well as a solution that worked smoothly with SOLIDWORKS. When we heard that SOLIDWORKS was launching a new 3DEXPERIENCE® WORKS simulation solution that incorporated the SIMULIA® Abaqus solver, we signed up for the Lighthouse Program so we could start using the new SIMULIAworks immediately."

InFocus first utilized SIMULIAworks on the bearing section of the company's RE|FLEX Premium HP/HT Drilling Motor. The motor's bearing section is a proprietary design that was developed to convert extreme loading parameters, including torque of over 30,000 foot-pounds, into efficient drilling action. The company's initial concept design of the drive system, which utilized traditional ball bearings, resulted in failure during testing when the load crushed the bearings and the faces that load the bearings. SIMULIAworks predicted the failure—with accurate correlation to actual test results—and helped the company develop a better, more innovative design.

"Because we analyzed our options in software, we didn't need to physically test all of the possibilities and ran just a few verification tests on the design validated in SIMULIAworks, which confirmed that our simulation results were accurate," Kjellbotn stresses. "This allowed us to optimize critical internal components for cyclic fatigue-loading [bending stress], a common cause of twist-offs downhole, and confirm a higher torque rating and increased durability for our product."



By implementing SOLIDWORKS design and analysis tools, and the integrated SIMULIAworks application on the 3DEXPERIENCEWORKS platform, InFocus saved tens of thousands of dollars in testing costs, cut months of time and extra labor from its development process, realized close correlation between simulation and testing results, freed up computing resources for other functions, and saved money otherwise spent on unnecessary mold iterations.

READ THE WHOLE STORY

To read the full InFocus story, click [here](#).



ACCELERATING
INNOVATIVE INDUSTRIAL
EQUIPMENT DEVELOPMENT
WITH SIMULATION

ADVANTAGES OF
SIMULATION-DRIVEN
DEVELOPMENT COMPARED
TO PROTOTYPE-DRIVEN
DEVELOPMENT

A CASE IN POINT:
RESEMIN

INTEGRATED SIMULATION
A "MUST" FOR
INDUSTRIAL EQUIPMENT
MANUFACTURERS

A CASE IN POINT:
BUROCCO

IS STRUCTURAL
SIMULATION ENOUGH,
OR DO WE NEED MORE?

A CASE IN POINT:
CAPRARI

CREATE INNOVATIVE
PRODUCTS MORE QUICKLY
WITH SOLIDWORKS
SIMULATION SOLUTIONS

A CASE IN POINT:
INFOCUS ENERGY SERVICES

A CASE IN POINT:
PLASTIC COMPONENTS

CONCLUSION

... A CASE IN POINT

IMPROVING SPEED AND ACCURACY OF INJECTION MOLDING WITH SOLIDWORKS PLASTICS PREMIUM

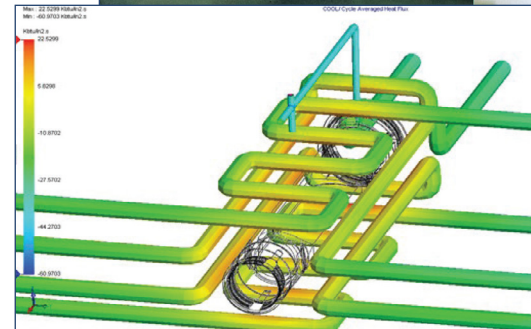
Shipping over 20 million parts per month to customers worldwide, Plastic Components, Inc. is a world-class manufacturer of small- to medium-sized plastic injection-molded parts. According to Business Development Manager Rick Riesterer, the plastic part producer's rapid growth is partly due to its commitment to leveraging emerging technologies to meet and exceed customer expectations.

This commitment to technology led the company to standardize on SOLIDWORKS 3D design software in 2006, which the company's engineers use to assist their customers with component design. In 2016, management decided to bolster the company's mold-filling simulation capabilities to reduce mold iterations, so that the company could more quickly deliver customer parts and eliminate unnecessary costs.

"We wanted to take our mold-filling simulation capabilities to the next level to help our customers meet increasingly shorter time-to-market goals and reduce our internal costs on the back end," Riesterer notes. "So we conducted a comprehensive evaluation of the top four mold-filling simulation solutions on the market and benchmarked each solution against a part with a known issue, so we could assess the accuracy of each solution and determine how the results of each correlated to a real-life component."

After benchmarking each solution in terms of accuracy and predictability, data output, ease and consistency of use, and quality of support, Plastic Components chose SOLIDWORKS Plastics Premium mold-filling simulation software.

With SOLIDWORKS Plastics Premium, Plastic Components has minimized mold iterations. "We partner with our customers to help them validate each design concept for manufacturability, functionality, assembly, and sustainability before developing the mold," Riesterer says. "Before we added SOLIDWORKS Plastics Premium software, we'd sometimes discover an issue on very complex components during the first mold trial that would require a second, third, or more trials. On those type components, our objective is to reduce the number of 'round trips' for two reasons: helping our customers achieve their time-to-market objectives and reducing our back-end costs. SOLIDWORKS Plastics Premium software provides the advanced capabilities—such as post-filling, cycle optimization, cooling analysis,



and warp prediction—that allow us to simulate complex mold scenarios, accelerate customer time to market, and reduce internal launch costs.

By adding SOLIDWORKS Plastics Premium software to its SOLIDWORKS implementation, Plastic Components cut weeks from the back end of its mold and tooling development process, minimized the number of mold iterations, increased the accuracy of mold-filling simulations, and saved money otherwise spent on unnecessary mold iterations.

READ THE WHOLE STORY

To read the full Plastic Components story, click [here](https://www.plasticcomponents.com).



ACCELERATING
INNOVATIVE INDUSTRIAL
EQUIPMENT DEVELOPMENT
WITH SIMULATION

ADVANTAGES OF
SIMULATION-DRIVEN
DEVELOPMENT COMPARED
TO PROTOTYPE-DRIVEN
DEVELOPMENT

A CASE IN POINT:
RESEMIN

INTEGRATED SIMULATION
A "MUST" FOR
INDUSTRIAL EQUIPMENT
MANUFACTURERS

A CASE IN POINT:
BUROCCO

IS STRUCTURAL
SIMULATION ENOUGH,
OR DO WE NEED MORE?

A CASE IN POINT:
CAPRARI

CREATE INNOVATIVE
PRODUCTS MORE QUICKLY
WITH SOLIDWORKS
SIMULATION SOLUTIONS

A CASE IN POINT:
INFOCUS ENERGY SERVICES

A CASE IN POINT:
PLASTIC COMPONENTS

CONCLUSION

DEVELOP INNOVATIVE, HIGH-QUALITY INDUSTRIAL EQUIPMENT WITH SOLIDWORKS SIMULATION SOLUTIONS

Developers of industrial equipment and manufacturing tooling can more quickly respond to changing market demands and emerging demands for more specialized products by incorporating integrated SOLIDWORKS simulation technology into their product development processes. Completely embedded inside the SOLIDWORKS 3D design system, these simulation tools can help product developers create innovative, high-quality, and more specialized industrial equipment more quickly and cost-effectively, minimizing costly, time-consuming rounds of physical prototyping and accelerating time to market.

Integrated SOLIDWORKS simulation solutions will help industrial equipment manufacturers leverage the insights provided by simulation-driven design to develop new approaches and breakthrough products in less time and at less cost. These capabilities provide the boost that manufacturing organizations need to overcome the competitive, market segmentation, and specialization pressures that they currently face and deliver industrial equipment that exceeds customer expectations.



To learn more about how integrated SOLIDWORKS Simulation solutions can improve your development of industrial equipment, visit www.solidworks.com, or call 1 800 693 9000 or +1 781 810 5011.

Our **3DEXPERIENCE®** platform powers our brand applications, serving 11 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes, the **3DEXPERIENCE** Company, is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating 'virtual experience twins' of the real world with our **3DEXPERIENCE** platform and applications, our customers push the boundaries of innovation, learning and production.

Dassault Systèmes' 20,000 employees are bringing value to more than 270,000 customers of all sizes, in all industries, in more than 140 countries. For more information, visit www.3ds.com.



3DEXPERIENCE®

ACCELERATING
INNOVATIVE INDUSTRIAL
EQUIPMENT DEVELOPMENT
WITH SIMULATION

ADVANTAGES OF
SIMULATION-DRIVEN
DEVELOPMENT COMPARED
TO PROTOTYPE-DRIVEN
DEVELOPMENT

A CASE IN POINT:
RESEMIN

INTEGRATED SIMULATION
A "MUST" FOR
INDUSTRIAL EQUIPMENT
MANUFACTURERS

A CASE IN POINT:
BUROCCO

IS STRUCTURAL
SIMULATION ENOUGH,
OR DO WE NEED MORE?

A CASE IN POINT:
CAPRARI

CREATE INNOVATIVE
PRODUCTS MORE QUICKLY
WITH SOLIDWORKS
SIMULATION SOLUTIONS

A CASE IN POINT:
INFOCUS ENERGY SERVICES

A CASE IN POINT:
PLASTIC COMPONENTS

CONCLUSION