SOLIDWORKS

THE FIVE WAYS ARTIFICIAL INTELLIGENCE WILL REVOLUTIONIZE PRODUCT DEVELOPMENT

DASSAULT SYSTEMES

INTRODUCTION

Mark Twain quipped, "Never let the truth get in the way of a good story." Engaging with the drama or controversy found in the stories we encounter on TV, social media, or even via word of mouth often opens the doorway to our most profound questions and intense fears about life. A Harvard T.H. Chan School of Public Health study shows that negative news headlines or social media posts typically garner more clicks. Therefore, it may not be surprising that urban legends regarding artificial intelligence (AI) abound. It's human nature to love the dramatic.

"The current characterization on popular media is that AI is connected to something mysterious, something that came out of nowhere, and something that will give free license to create a dystopian type of society," says Gian Paolo Bassi, Dassault Systèmes Senior Vice President of **3D**EXPERIENCE® Works. The technology behind AI is not that new, and it isn't particularly scary, either. Bassi continues, "Artificial intelligence is basically moving computer science to the next level." Of course AI will profoundly affect society, but maybe not how some of us would like to imagine.

Computing technology and the internet have clearly had a huge impact on our world. According to some estimates, the amount of data generated worldwide tops 300 million terabytes per day. "What was missing is how to make sense of all this information—that's what AI brings to the table," notes Bassi. Thanks to advances in computational power, AI can analyze vast datasets, which goes beyond mere data storage and retrieval speeds. "It took us a lot of time to create a CAD system and the cloud-based platform, but in the end, everybody in the world can use the same type of technology to build everything from airplanes to consumer products," explains Bassi. This analogy also holds true for AI modeling technology.

Imagine language models like OpenAI's ChatGPT or Google's Gemini, except trained on product development data. "We take a dataset of any kind and create an AI model on top of it, which can give us answers; this is absolutely unprecedented," continues Bassi.

AI-powered CAD is moving beyond the ideation phase, poised to enter the mainstream. In fact, SOLIDWORKS® customers already enjoy AI-powered tools and functionality and can anticipate even more in future releases. This paper will discuss five ways AI will revolutionize product development:

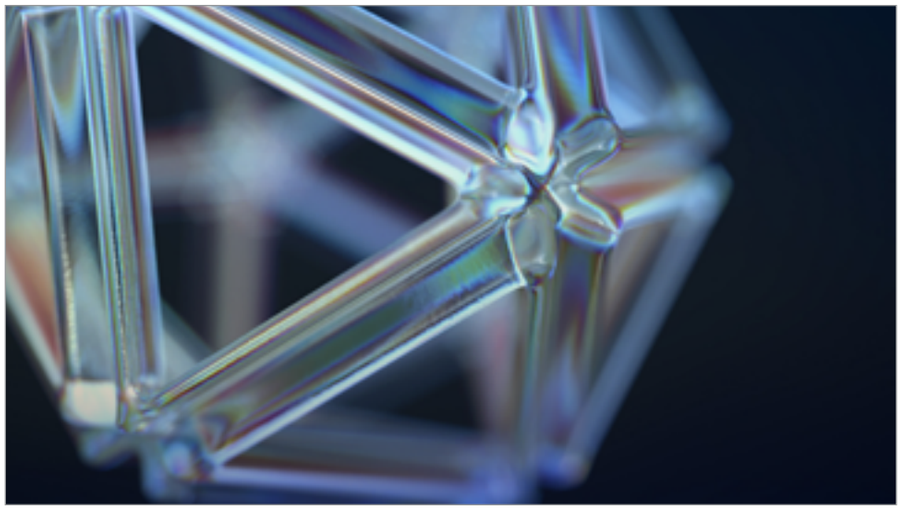
1. Enabling Product Development to Shift Left
2. Building New Products Faster and More Efficiently
3. Conducting Real-Time Multiphysics Simulation
4. Transforming Customer Support Data Into Product Enhancements
5. Innovating New Materials

ENABLING PRODUCT DEVELOPMENT TO SHIFT LEFT

The concept of *shift left* in product development refers to the strategy of identifying and addressing issues as early as possible in the product life cycle, ideally during the ideation or design phases. Traditionally, new products undergo several stages: ideation, design, and engineering, which may or may not include simulations to ensure functionality in real-world environments, such as manufacturing, release, and customer usage. Often, customers identify problems after release, necessitating a return to the earliest stages of development for corrections. This cycle can be costly and time-consuming.

"Typically, the earlier a problem can be found, the earlier a problem can be fixed; the cheaper it is, the faster it is, the better it is," explains SOLIDWORKS CEO Manish Kumar. "Now, the beauty of AI will be that it will help us shift left." According to Kumar, downstream product development problems may become a thing of the past. He continues, "If we can detect that problem up front, right at design time, the whole pain of finding the problem shifts left. In fact, I may not even introduce the problem. I'll do the right thing at the right time, the very first time, and it will help everyone be more productive."

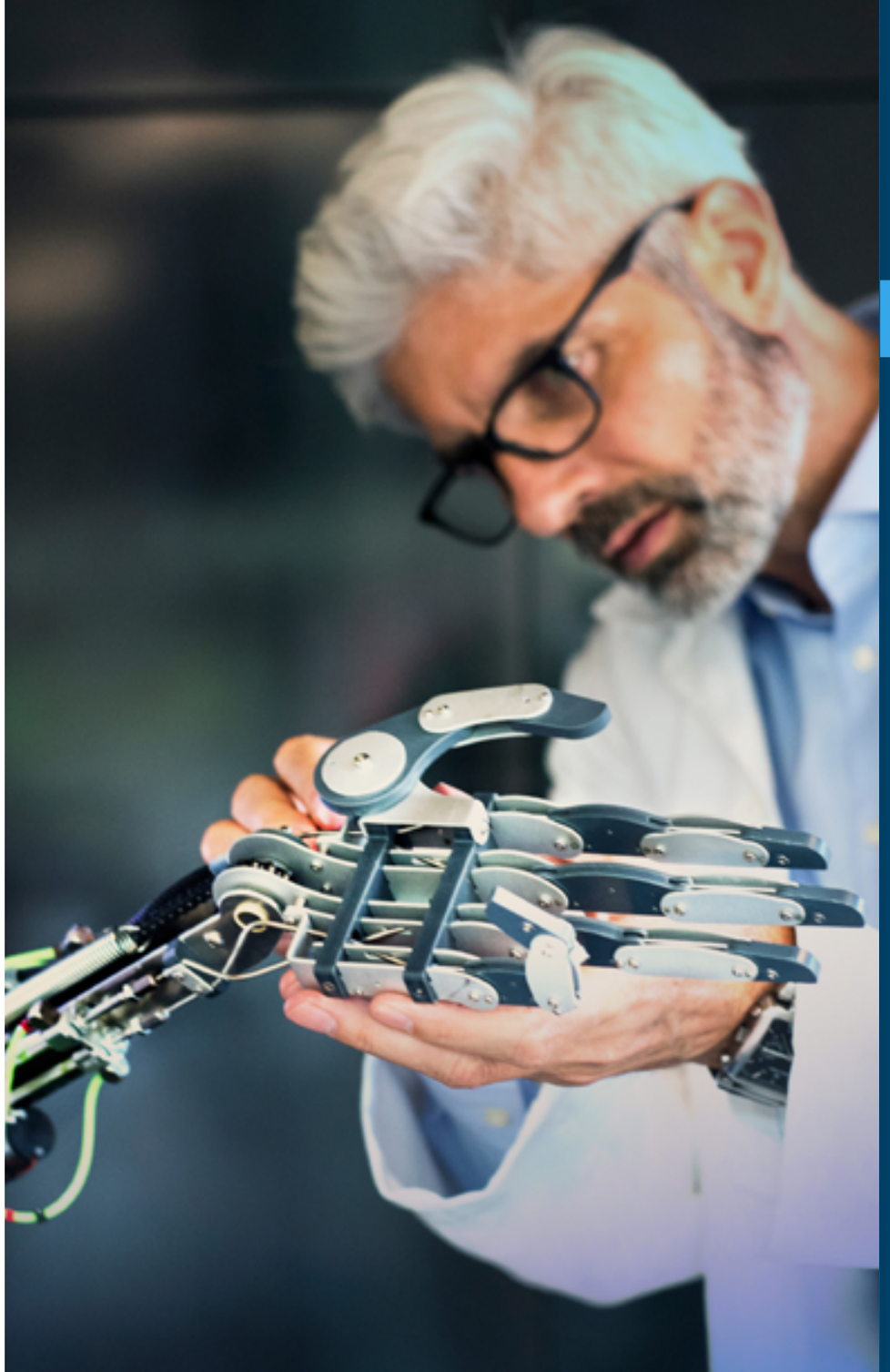
By preventing issues before they occur, AI can streamline the development process, reduce costs, and increase productivity. Additionally, this approach is more environmentally friendly, as it minimizes waste from producing faulty products. Ultimately, shifting left with the aid of AI not only improves the efficiency of the design and manufacturing process but also leads to the production of higher-quality, more reliable products. "Artificial intelligence depends on past data that can give these kinds of insights," adds Kumar. "It will allow our users to have a shift-left kind of mindset: Find problems and fix them right at design time. And, to me, that is one of the biggest helps that AI can possibly give to our designers."



BUILDING NEW PRODUCTS FASTER AND MORE EFFICIENTLY

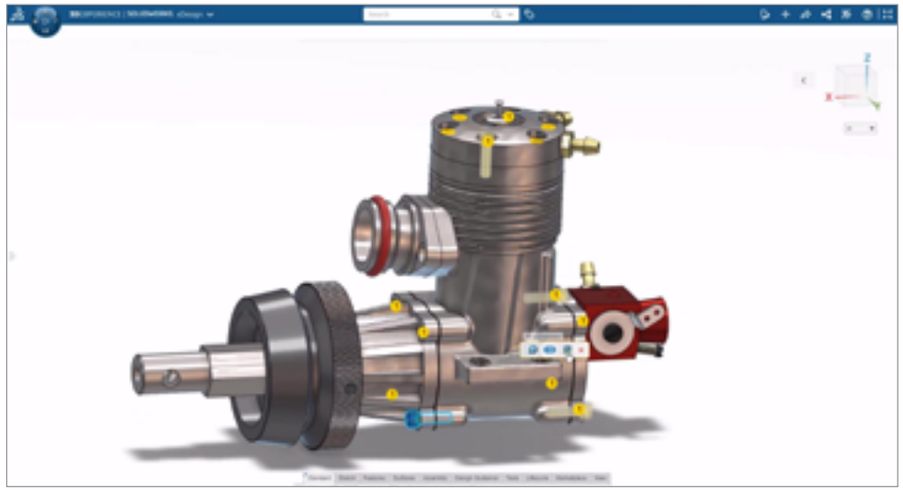
Dr. Shrikant Savant is a seasoned AI and machine learning (ML) innovator who has spearheaded the development of numerous cutting-edge design and simulation technologies. As the director of data science and artificial intelligence at SOLIDWORKS, Savant has achieved significant milestones. He pioneered the use of machine learning-enhanced tools, which have transformed the daily activities of SOLIDWORKS users. Additionally, he has steered Dassault Systèmes R&D efforts toward adopting a more AI-centric development framework. "AI and ML are not new to SOLIDWORKS," notes Savant. "We have been working on them for several years and have released many AI/ML-powered functionalities in many of our products."

Artificial intelligence is an umbrella term for strategies and techniques that enable machines to mimic human intelligence. The vision at SOLIDWORKS is to provide AI/ML tools that function like an experienced designer looking over your shoulder—answering questions and offering suggestions and tips so you can avoid costly mistakes and build better products. SOLIDWORKS realizes this vision by using a two-pronged approach. The first prong is to provide AI-powered tools for design assistance; the second prong is to provide AI-powered tools for generative design.



Design Assistant

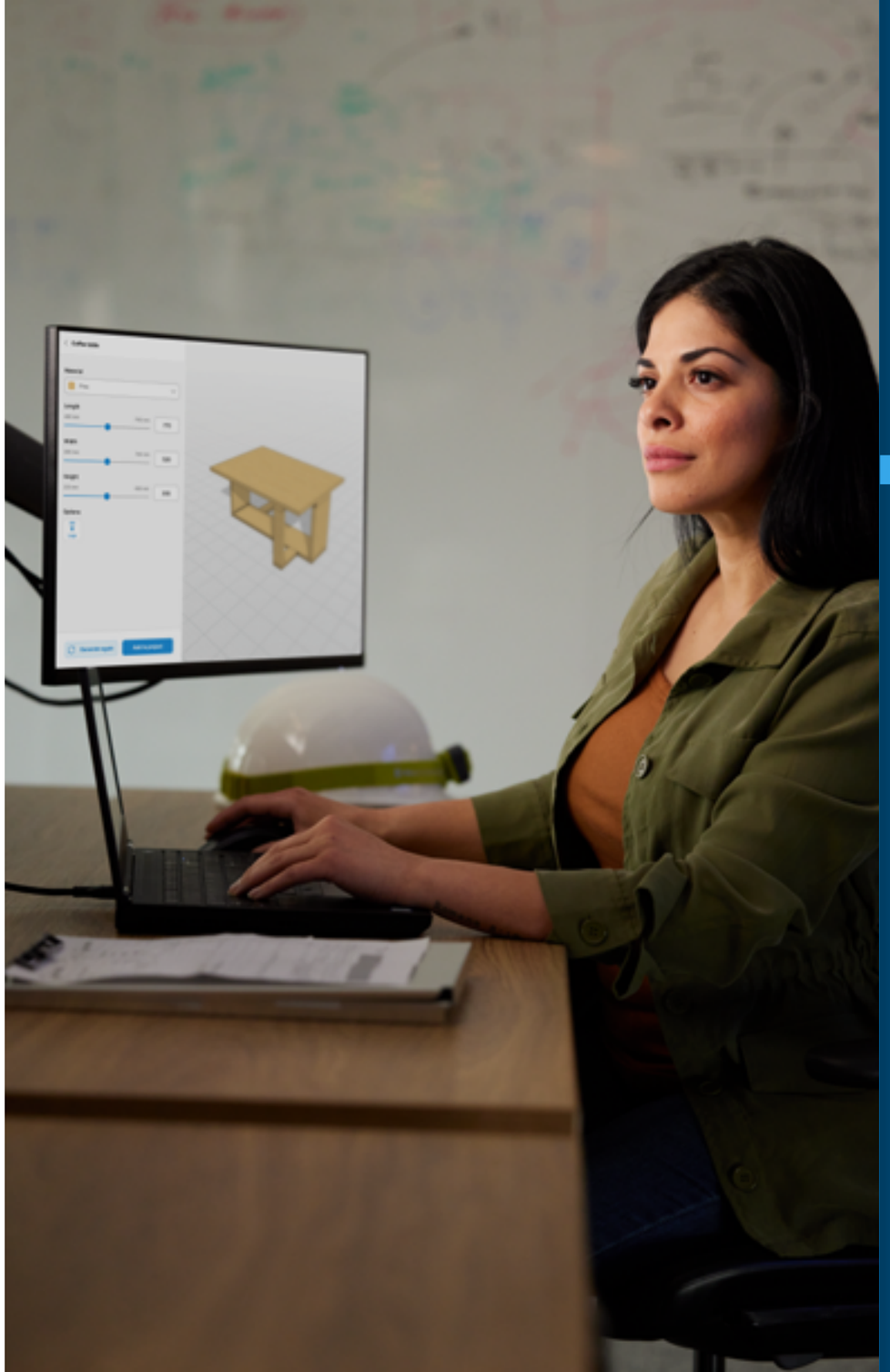
The design process is often complex. Properly completing a design typically involves a series of repetitive steps that must be completed with precision and attention to detail. "Our goal for AI is to reduce the tedium in the design process and improve the user experience," explains Savant. The Design Assistant automates mundane tasks with AI; however, the user is still in control. "We want it to be as unobtrusive as possible," emphasizes Savant. "All suggestions [by the Design Assistant] try not to make too many assumptions. We don't want to disrupt the user's workflow." One command can accomplish many things. A single click from a list of smart options found in the AI-driven Design Assistant can enable you to automatically create multiple selections—or fillets or fasteners or mates or shapes or the like—and precisely place them into your design, relieving you of the monotonous work that your computer can do much faster anyway.



Generative Design

Imagine automatically creating multiple design solutions by simply inputting design requirements such as weight, strength, material types, durability, manufacturing methods, and costs. That is the magic of generative design. The built-in AI/ML capabilities enable the system to learn from each iteration and improve design with each subsequent generation. Generative design leverages machine learning, a subset of AI focused on building systems that can learn from data. Machine learning enables computers to improve performance on a specific task over time without being explicitly programmed.

While AI for generative design is still in its infancy when it comes to creating highly complex mechanical designs, there are simple yet powerful examples of generative design tools that almost everyone can try, such as MakeByMe. A free web-based tool, MakeByMe helps you build your wooden furniture from start to finish. Similarly, CAD systems with generative design capabilities will enable designers and engineers to input design goals, parameters, and constraints and then automatically generate a multitude of design alternatives that meet the specified criteria. The ability to quickly generate and assess numerous design options significantly accelerates the design process, especially during the conceptual phase.

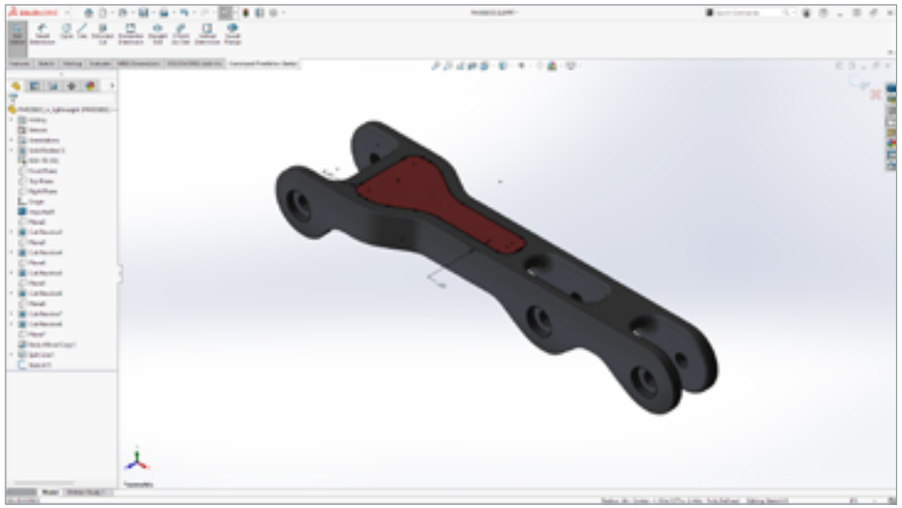


Learn Quickly and Minimize Monotony

AI capabilities will help make SOLIDWORKS more accessible to new users. It will also eliminate much of the tedium for experienced users who update existing products. “For the novice designer, who doesn’t know anything or doesn’t have enough experience, AI will help them get started quickly,” asserts Savant. “For somebody doing a lot of similar processes day in and day out, because you have multiple designs and a lot of repetitious work, this is where generative design can help.”

AI Command Prediction

AI Command Prediction is now available in SOLIDWORKS. An example of using AI to assist in the design process, AI Command Prediction improves productivity and design quality by letting AI predict your next command.



CONDUCTING REAL-TIME MULTIPHYSICS SIMULATIONS

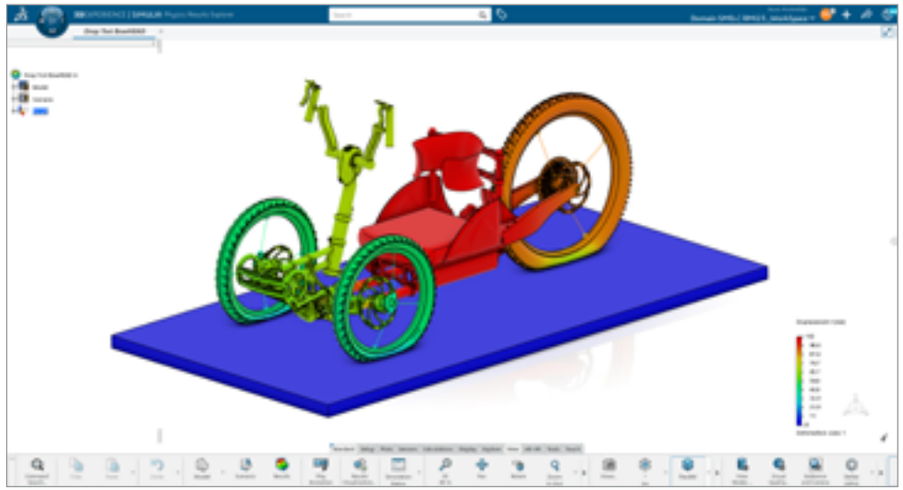
Before the advent of finite element analysis (FEA) software, physical testing was a cornerstone of design validation. Mechanical engineers often built physical models to gather data about performance, durability, and potential failure points. Early FEA software was usually complicated to learn and use. And if you didn't have a Ph.D. on staff, you'd have to outsource a highly specialized consultant to interpret the FEA software's results.

Today, SOLIDWORKS is one of the world's leading 3D CAD systems because of its ease of use and robust functionality. The development teams at SOLIDWORKS have worked hard to democratize simulation. By closely coupling 3D modeling and simulation (MODSIM), companies can prevent failures early in the design process. Digitally predicting how designs will behave in the physical world significantly reduces and sometimes eliminates the need for physical prototypes.

However, simulation setup can still be cumbersome because of the need to create numerous boundary, load, and contact conditions, along with other parameters and requirements. Artificial intelligence may be able to take the democratization of simulation to the next level because it can also help with the setup of a simulation analysis. "There are a lot of rules that an AI learning model could absorb," says Bassi. "The [generative] model itself could run the simulation in real time."

As mentioned, engineers input basic design requirements in a generative modeling environment, including strength, durability, and manufacturing criteria. The software then generates geometric solutions and refines them based on specified criteria. Finally, it identifies optimal designs and automatically modifies them—via simulation in real time—to reduce weight, enhance performance, or improve manufacturability. Most engineers find it advantageous to have options, and the generative design process can automatically produce several of them, which have already been tested and optimized to function in the real world. And because generative design leverages AI/ML, every iteration learns from previous work, so continuous improvement is built in.

Bassi concludes, "Multiphysics simulation in real time will change how we design products. The algorithms are so strong right now in simulation. Whatever you came up with in geometrical terms, the simulation can give you the final answer."

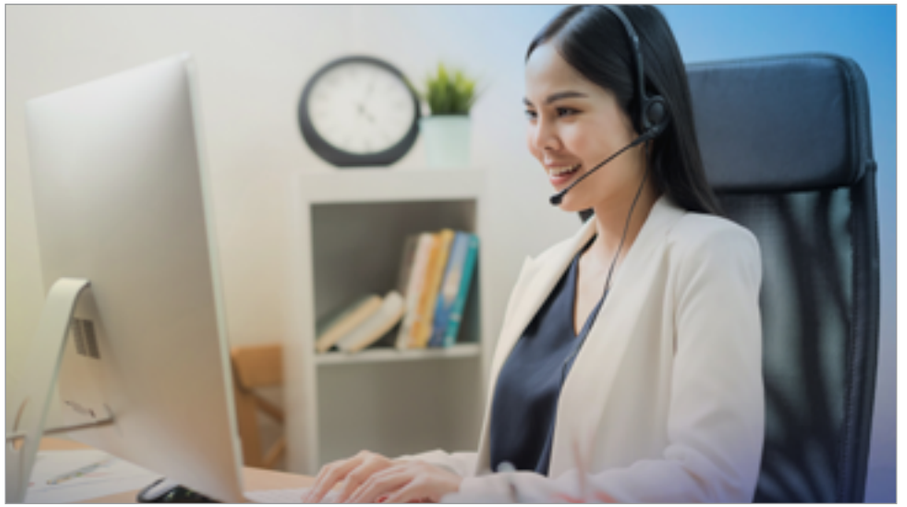


TRANSFORMING CUSTOMER SUPPORT DATA INTO PRODUCT ENHANCEMENTS

SOLIDWORKS has gone to great lengths to make its program powerful and easy to use. Some would argue that one of the biggest drivers of its success is obsession with user feedback, a hallmark of the company's culture. This isn't simply passive listening; it's an active engagement with the worldwide SOLIDWORKS Community. The top user suggestions have been translated into tangible updates in the software every year for the past 30+ years.

Imagine harnessing decades of SOLIDWORKS customer support data and user feedback from millions of users to train AI models. According to Bassi, "I think this is a huge area of application of artificial intelligence, basically improving the quality of the products in areas that matter the most for customer satisfaction."

A good example is using AI to automate analysis of the accumulated customer feedback, identifying common issues and trends that human analysts might miss or take longer to recognize. This process not only speeds up the response to emerging customer needs but also allocates SOLIDWORKS resources more effectively. Bassi acknowledges the difficulties and inefficiencies of manually leveraging customer feedback without the benefit of AI-driven automation. "It is a painstaking exercise that requires human intelligence and a lot of tedious work. And in the end, we are never sure that the resources are allocated where we get the most bang for our buck."



Furthermore, leveraging AI in this context extends beyond simple automation. It involves deep learning from real-world usage and customer feedback to refine product features. AI could realistically revolutionize how companies process customer feedback and innovate products going forward.

Leveraging the wealth of customer support and feedback data via AI doesn't just streamline operations; it enables a relationship in which both the company and its users continuously evolve and improve through shared knowledge and advanced analytics. "The lessons learned from QA or real-world user feedback or the previous generation of products can create enormous opportunities," Bassi asserts. This capability to learn and grow from the data in tangible ways underscores an essential shift toward a more cohesive, responsive, and targeted product development effort.

A properly trained and implemented AI model can create an environment where customer needs are quickly and accurately analyzed to provide immediate and longer-term product solutions. "The model is an architecture to capture knowledge," explains Bassi. "Training the model is really where artificial intelligence goes deep." Feeding the AI algorithm large amounts of data enables it to learn patterns, make predictions, or understand nuances, which is essential for its ability to perform tasks accurately and effectively.

INNOVATING NEW MATERIALS

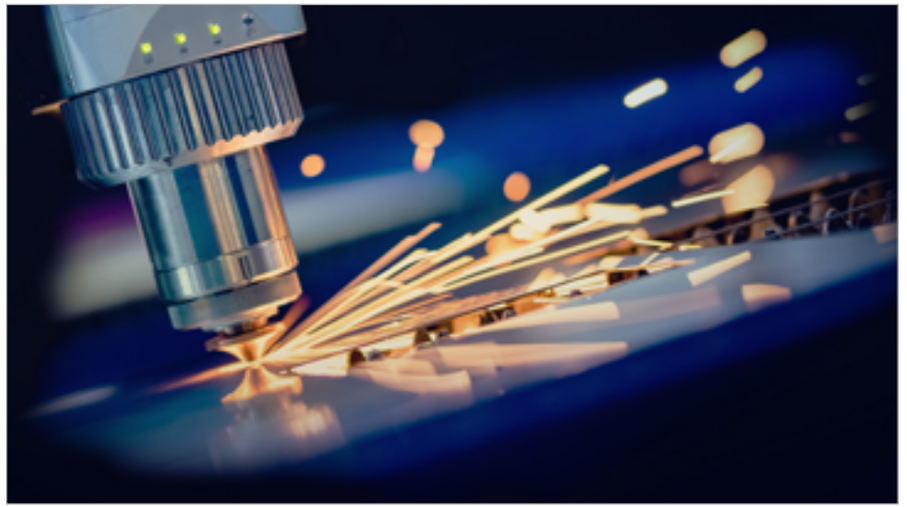
The pharmaceutical industry leverages AI to invent new compounds in several innovative ways. AI can analyze vast amounts of biological and medical data to identify potential critical targets in disease processes. AI also helps researchers understand how these targets interact with diseases at a molecular level. This involves simulating molecular dynamics and interactions, speeding up the initial drug discovery phases.

Why not leverage AI to help innovate materials for manufactured goods?

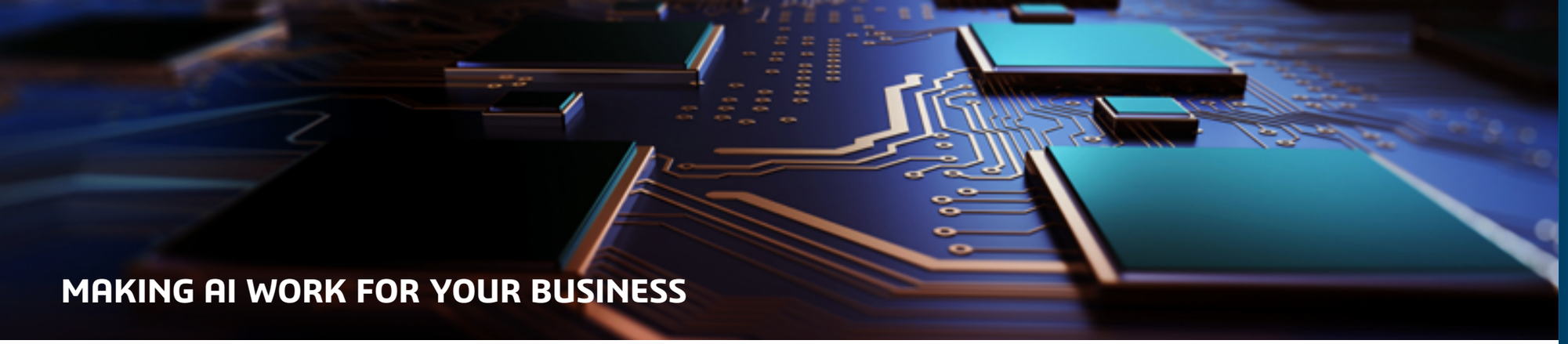
"Another promising field is the invention of materials, similar to how artificial intelligence is employed in pharmaceuticals to develop new compounds," notes Bassi. "One of the most exciting aspects of 3D printing technology is its ability to rapidly and cost-effectively create new alloys." Traditional methods of alloy development can be time-consuming and costly, often involving multiple stages of melting, casting, and processing of metals. 3D printing simplifies this process. It uses layers of metal powder fused together, which means new alloys can be tested and iterated quickly without extensive tooling or setup changes.

"Innovations in 3D printing now allow for materials whose electrical and physical properties vary within the same product. This creates a gradient of material composition that is programmable via the printing process, enabling different parts of the same item to have varying rigidity or electrical conductivity," explains Bassi. "The result is the development of structures that can function without traditional joints and motors, reacting instead to electrical stimuli [in the material]."

Bassi continues, "For example, it is now feasible to design an artificial finger from a single piece of metal rather than assembling multiple linked segments with motors. Artificial intelligence is integral in pinpointing the precise material composition and layout for such innovations." AI can also be vital in optimizing complex manufacturing processes, which requires significant expertise; the selection of materials, machinery, and manufacturing techniques can substantially impact the quality of a final product.



Another opportunity lies in leveraging AI for sustainable design. "By incorporating sustainability goals into AI's generative models, the entire design process can reflect these objectives," asserts Bassi. However, researchers must integrate knowledge from different fields, including geopolitical considerations. For instance, sourcing cobalt from a region under an unstable government raises questions about material and costs. Ethical implications regarding labor may also be of concern. "These complexities are often beyond human capacity to manage alone but can be effectively addressed by [AI's] advanced machine learning models that provide precise and timely insights," concludes Bassi.



MAKING AI WORK FOR YOUR BUSINESS

Consumers today want more than just innovative and useful products. They want great product experiences. Companies must react quickly to deliver meaningful innovation under compressed timelines. To stay competitive, companies must rethink traditional business processes and embrace new technologies such as AI to streamline design, manufacturing, and operations. Manufacturers must shift from disconnected tools and methods to fully integrated, cloud-based product development solutions to keep pace with ever-changing technology and ever-evolving customer needs.

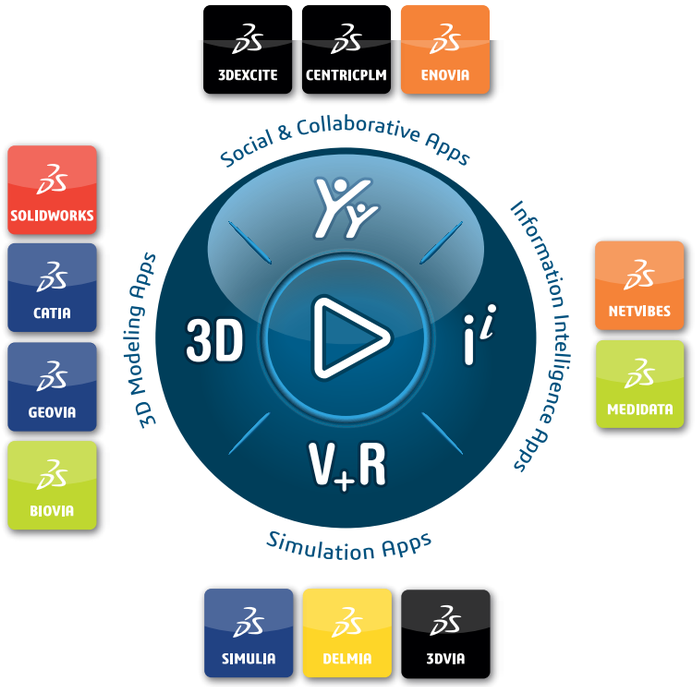
Businesses can leverage integrated product development tools from the **3D**EXPERIENCE Works portfolio with SOLIDWORKS, connected to the cloud-based **3D**EXPERIENCE platform. This combination fosters innovation, facilitates collaboration, streamlines development, and helps manage costs as it becomes part of your product development workflow. Each person on the platform has access to all the applications and data needed to contribute to and expedite the innovation process from concept to delivery. Advanced tools and technologies for product development encompass these areas:

- **Design** – Create and share designs quickly, enabling key stakeholders to give and receive feedback throughout product development.
- **Simulation** – Quickly validate designs to gain insights into product performance, reliability, and safety at any point in the development process to inform decision-making.
- **Data Management** – Automatically capture and manage all development-related data to manage revisions, work through formal change actions and approvals, and monitor project tasks.
- **Manufacturing** – Streamline communication among all departments, from the back office to the shop floor, to identify and reduce errors at any phase for faster release to production.

Remote access to design data is nonnegotiable for many manufacturers. By leveraging the cloud-based **3D**EXPERIENCE platform—a single source of truth for all product development data—manufacturers can easily and securely connect to their data from any location. Even suppliers and partners can contribute their expertise at any point in the process.

Communications among team members are automatically tracked in one accessible location on the **3D**EXPERIENCE platform, eliminating the drudgery of tracking and organizing interactions among team members. Plus, data management is built in: The unified product definition updates automatically in real time so everyone on a project connected to the platform is always in sync.

SOLIDWORKS is committed to harnessing the power of AI to advance product development. You will be able to build products faster and more efficiently while automatically validating design quality before the prototyping stage. Furthermore, leveraging AI to analyze customer support data allows key enhancements to be quickly and accurately derived for future development. Finally, AI-driven materials innovation will enhance product durability and sustainability. Contact your local reseller for a demonstration. See how investing in the right tools can enhance your product development process to help you get more innovative products to market faster.



Our **3D**EXPERIENCE® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating virtual twin experiences of the real world with our **3D**EXPERIENCE platform and applications, our customers can redefine the creation, production and life-cycle-management processes of their offer and thus have a meaningful impact to make the world more sustainable. The beauty of the Experience Economy is that it is a human-centered economy for the benefit of all – consumers, patients and citizens.

Dassault Systèmes brings value to more than 300,000 customers of all sizes, in all industries, in more than 150 countries. For more information, visit **www.3ds.com**.

DASSAULT SYSTEMES

Europe/Middle East/Africa
Dassault Systèmes
10, rue Marcel Dassault
CS 40501
78946 Vélizy-Villacoublay Cedex
France

Asia-Pacific
Dassault Systèmes
17F, Foxconn Building,
No. 1366, Lujiazui Ring Road
Pilot Free Trade Zone, Shanghai 200120
China

Americas
Dassault Systèmes
175 Wyman Street
Waltham, Massachusetts
02451-1223
USA