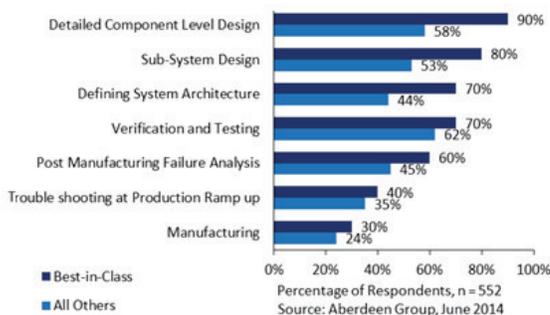


Anticipating the Next Revolution in Engineering Simulation



There's no doubt that engineering simulation has made an indelible impact on the work of product development teams. By enabling designers to study, predict and verify their products' performance in a low-cost, low-risk virtual environment, simulation has accelerated the journey from conception to market launch, slashed development costs and increased product reliability. However, conventional simulation software does have its limitations — most notably, the lengthy training and consistent use required to build and maintain simulation expertise. In order to usher in a new era of simulation “democratization” — in which many team members can easily master simulation — a new generation of software is needed. Forward-looking software solutions will allow companies to apply simulation in a more flexible manner, improve the accuracy of the development process, enable multiple physics to be studied simultaneously, and increase collaboration and best-practice adoption. In addition, by allowing for easy software customization, next-generation simulation solutions will maximize results for every engineer, in every industry.



The Democratization of Engineering Simulation

A recent study by Aberdeen demonstrated that best-in-class companies are more likely to use simulation at every phase of product development. In order for the typical company to achieve this, simulation software must be “democratized” — made so user-friendly that every member of the design team is able to leverage its scope and power.

When engineering simulation was introduced more than 45 years ago, it truly revolutionized the product development process. Suddenly engineers had a new tool for designing products, subjecting them to various physical forces and verifying their performance — all in a risk-free virtual environment. Manual calculations, expensive prototypes, and time- and cost-intensive physical testing could be significantly reduced, and new products could be pushed through the development cycle much faster.

Over the years, improvements in solver speed, meshing, physics coupling, post processing and design parameterization, coupled with the rise of high-performance computing, have made simulation even more powerful and more applicable to a broad range of engineering challenges. Today, brand leaders in virtually every industry — from aerospace and automotive to health care and consumer products — rely on engineering simulation to deliver new products and innovative features to market both quickly and cost-effectively.

However, a number of recent trends have impacted the product development process, forcing engineering teams to work in new ways. Increasing global competition has required companies to dramatically lower their costs, while simultaneously delivering more new products faster than ever. As staffing budgets have been reduced, companies must also do more with fewer people, including in critical functions such as engineering.

The answer to all these challenges? Companies must not only increase their use of simulation, but make it a more “democratic” tool that can be used by everyone on the development team — from veteran product engineers to less-experienced designers at the beginning of their careers.

Overcoming the Limitations of Traditional Solutions

There’s only one problem with this strategy: Traditional engineering simulation tools have been developed with expert users in mind — and in today’s challenging environment, the typical product development team cannot afford to be staffed with specialists. As a result, today most teams leveraging simulation are forced to do so in a limited way.

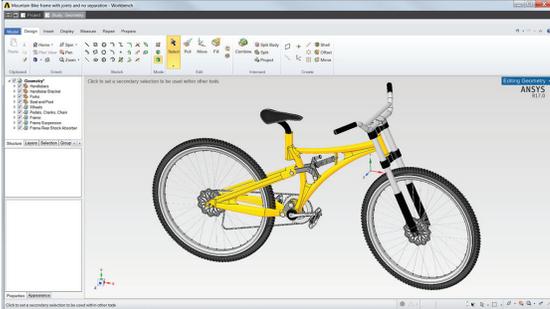
Most product development teams consist of many generalists, or broadly skilled design engineers, along with just a handful of specialist engineers who have been trained specifically to perform complex simulations. The need for specialized training often slows the entire team, as the number of projects usually awaiting simulation and analysis at any one time creates a workflow bottleneck. Instead of being widely used throughout the product development process, on an everyday basis, simulation is often reserved for special design challenges.

The past 45-plus years have proven that engineering simulation can help speed innovation, address pressing customer needs and launch products faster than competitors. But in today’s world of reduced budgets, decreased staffing and incredible competitive pressures, current-generation simulation software is not achieving its potential to support continued product innovation and establish a significant engineering advantage.

Next-Generation Software: A Strategic Imperative

In this new engineering environment, what’s needed is a completely reimagined simulation solution that can be more broadly used by more people — without the need for specialized training or a specific skillset. A more flexible, easy-to-use toolkit would represent a true game-changer for engineering teams looking to increase their productivity and design outputs, without sacrificing product reliability.

If this new tool were available, simulation could be used throughout the entire product development process, including at the earliest design stages, when identifying design flaws can save months of time and huge financial investments. Design engineers would have even greater freedom to innovate, since simulation is a low-cost, low-risk way to try out highly creative product ideas, without investing in prototypes or physical testing.



The Power of an Intuitive User Interface

Simulation software is, by nature, complex. But in order to foster broader usage of these solutions, that complexity needs to be delivered to the user in an easy-to-understand format that mimics popular consumer software products. A new solution, ANSYS AIM, was developed to make even sophisticated tasks such as geometry creation easy to master. With drop-down menus and visual cues, AIM enables users to quickly create, repair and simplify geometry for simulation – performing such common tasks as suppressing unwanted parts, removing small holes or creating fluid volumes.

A new, more democratic simulation tool would deliver a diverse range of strategic benefits. Five key advantages for engineering teams would be:

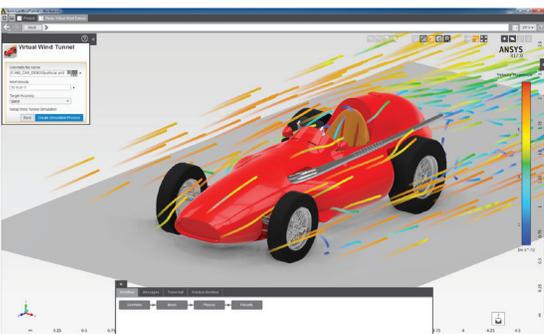
- The ability to apply simulation in a flexible, nonscheduled manner
- Greater accuracy in answering critical questions, instead of making “best guesses”
- Faster, easier multiphysics studies, performed by a single user
- Increased standardization of processes and improved collaboration
- The ability to customize simulation software to reflect in-house workflows and best practices

Each of these benefits is crucial to fueling innovation and creating a competitive edge in today’s increasingly crowded marketplace. Following is a discussion of how a next-generation simulation solution could deliver each of these benefits.

Simulation Anytime, Anywhere – by Anyone

If simulation software offered such features as an intuitive interface, process templates and clear navigation guides, it could be readily leveraged by new or infrequent users, without a steep learning curve or the need for regular training. By creating a simulation tool that’s more like common consumer software products – with colorful graphics and easy-to-understand cues – software providers could significantly increase the daily use of simulation, while also improving its long-term strategic impact.

Today, projects are often piled up on the desks of those few engineers who have been trained in conventional simulation solutions. But in an ideal world, anyone on the product development team could perform simulations on the fly as engineering challenges emerge.



Replace “Best Guesses” with Fact-Based Decisions

While current simulation software is applied in critical cases, a new solution called ANSYS AIM is easy to use and highly visual – enabling it to be applied at every stage of product development. By removing the element of blind prediction, engineering teams produce physical prototypes that perform as planned the first time – because that performance has already been verified from the earliest phases of the product development cycle.

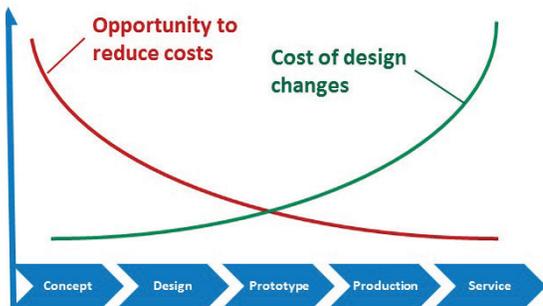
While simulation is currently reserved for a handful of challenges, in the future it might be applied at every single stage of the development process to identify and address flaws, predict performance and speed products to the next stage of the design cycle. If next-generation solutions could offer this capability, early adopters of a more democratized simulation toolkit could seize an engineering edge over their competitors.

Greater Product Reliability, from the Ground Up

Currently, product developers are forced to make a painful trade-off. Should they wait in line for a simulation-qualified engineer to study a given problem with a high degree of accuracy – even if it takes weeks or months? Or should they make a best guess about product performance and move quickly on to the next phase of the design cycle?

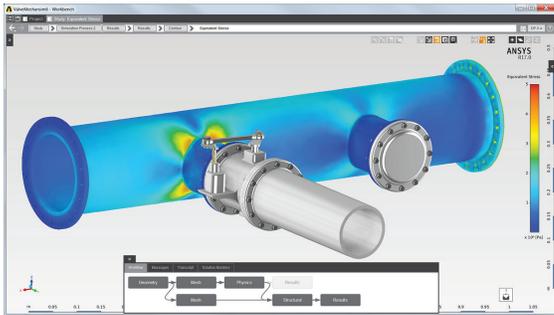
In a world of increasing competition and shorter life cycles, too often design engineers make the latter choice, even though it carries high risks. They predict the way their designs will perform in the real world, based on historical product performance or their own intuition, without verifying these assumptions via engineering simulation. Then they move on to prototype construction or physical testing.

Biggest Simulation Impact is Early in the Design Process



Eliminating Costly Design Changes

Thanks to its ease of use, ANSYS AIM can be utilized in every stage of product development. Any design issues can be flagged and fixed at the earliest possible stage, when changes are much less expensive and time-consuming to make.



Single User, Multiple Physics

With ANSYS AIM, there's no need to hand projects off to a series of specialists who analyze one physical force at a time. AIM provides an immersive, easy-to-use experience with task-based simulation workflows that enable a single user to rapidly apply multiple forces to a model – studying structural mechanics, fluid dynamics, thermal issues and electromagnetic effects. New users can start with one physics, while taking advantage of AIM's ease-of-use and guided simulation workflows, and later apply additional physics as engineering needs dictate.

While this strategy is aimed at accelerating market launch, in most cases it has the opposite effect. Late-stage design flaws are not only expensive to address, but they send the entire team back to the drawing board. Instead of a rapid, straightforward process – enabled by fact-based decision making via simulation – the design cycle becomes a continuous loop of estimating and re-estimating.

If engineers can gain access to an easy-to-use, flexible simulation tool, then product reliability can be built in from the ground up. Early-stage simulations – followed by iterative design studies as products move through development – result in prototypes that perform as expected, the very first time. Costly physical tests, such as wind tunnel testing and structural studies, can be minimized, saving both time and financial investments. Later in the product life cycle, warranty costs can be reduced and customer satisfaction improved. All these wins can be achieved simply by making engineering simulation a daily, ongoing part of the product development process – instead of an event that must be carefully scheduled and planned for.

Multiple Physics, Single Solution – and Single User

The current generation of simulation software requires a complete family of tools to study mechanical forces, dynamic fluid flows, thermal effects and electromagnetic performance. Each of these tools requires specialized training to master. This means that the product development team typically includes a series of physics specialists, trained in simulating a single physical force, who pass off design projects sequentially.

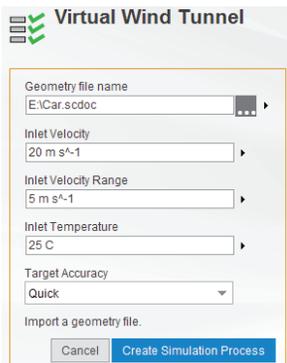
While effective in the past, this approach is proving insufficient in today's compressed engineering environment. Forward-looking simulation software should bring all the commonly used physics together in one easy-to-use, easy-to-navigate user environment. Without undergoing a lot of rigorous training, a single user should be able to virtually apply mechanical, fluid, thermal and electromagnetic forces as part of one continuous design exercise.

Ideally, users could choose from single and multiphysics capabilities in the same environment. New users might begin with single physics studies, then advance to multiphysics modeling as they acquire more sophistication in their simulation skills. As engineering teams become more flexible and fast-changing, scalability is a critical requirement for any new simulation solution.



Fostering Teamwork and Consistency

ANSYS AIM helps the global team function as a cohesive whole by establishing a set of consistent process templates and workflows. Because all users are working in a shared environment with a single process roadmap, it's easy to hand off design tasks and bring disparate components together to produce a finished product. For the first time, engineers from multiple disciplines can share common parts and terminology, enabling high-impact collaboration and ultimately a faster development cycle.



The Value of Customization

Because every team has its own collective engineering knowledge, best practices and governing standards, ANSYS AIM allows for a high degree of software customization and scripting flexibility. Expert users can automate complex simulation tasks for the entire team, as well as capture their knowledge and provide expert guidance to less experienced users. AIM's customization capabilities are based on native journaling and scripting. All interactive steps are captured in a journal file, which can be modified to create custom templates and workflows that enforce best practices.

Improved Collaboration and Process Consistency

Increasingly, engineers are working on shared product designs from multiple locations and in different time zones. They often are using different tools, making it hard to foster collaboration and consistency across the entire team. By using a common, easy-to-learn simulation environment, engineers can more easily hand off tasks and manage the overall development cycle.

Across the global team, individual engineers may be working on a single component or design aspect. As product launch nears, all these results must be merged to create a cohesive, consistent product system. If a single, democratic simulation tool was used by all team members, it would be very easy to merge results and bring the final design together.

In addition, a new simulation software package, with process templates and pre-determined workflows, would help standardize the way tasks are performed across the entire product development team — no matter where in the world engineers are located. From geometry creation to design optimization and results generation, everyone would be working with a common set of design processes and product development guidelines.

By automating proven best practices and common workflows, global engineering teams can ensure consistency across users, while also accelerating the pace of simulation to support faster market launches.

Customization for Every Engineering Team

Every engineering team has its own way of working, its own process flows and its own performance metrics. The next generation of simulation tools should represent the industry standard and deliver best-in-class capabilities — but, at the same time, be readily customizable for every product development organization.

The typical product development team includes “methods” specialists who capture and distribute engineering knowledge, providing guidance to all team members. Especially when simulation becomes a daily exercise, practiced by many team members, it is essential to establish governing standards and embed these right into the simulation tool. Templates, workflows and even the user interface should be easily customizable to reflect the unique practices of every company.

Customization will be most effective if it is based on native journaling and scripting via open-source tools and universal programming languages. The use of an expression language would also be helpful in enabling variable boundary conditions and other solution parameters to be defined via commonly understood expressions.

Simulation for Every Engineer

“For the simulation of different physical domains, for example structural mechanical simulations that are coupled with fluid mechanics, we have introduced the simulation software ANSYS AIM because of easy-to-use multiphysics coupling. Now our technicians and engineers with no special simulation knowledge are able to use multiphysics simulation in their daily work. We are pleased with ANSYS AIM, particularly by the intuitive interaction with the software, the integrated workflow templates and excellent user guidance.”

Richard Krellner,

Director Design Division, Klubert + Schmidt

Looking Toward a More Democratic Future

While engineering simulation has made an enormous impact on product development since 1970, it's time for a change in the way simulation is viewed. An era of software specialization and lengthy user training is being replaced with a more flexible future, in which each product development team is empowered to employ simulation across many team members and multiple design projects.

For the largest engineering organizations, the core group of simulation experts can be freed from routine simulations and allowed to focus on the most challenging simulation problems. Small and mid-sized companies can plan to use current resources and leverage simulation through next-generation software that is more intuitive, more user-friendly and easier to use than conventional solutions. This new wave of flexible, democratic software solutions will make engineering simulation an even higher-impact, more strategic capability that distinguishes the industry leaders from the also-rans.

By capitalizing on the next generation of simulation tools as quickly as possible, product development teams can quickly get out in front of competitors — and stay there via greater productivity, more accurate results and a much shorter development cycle.

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