

Tech-Clarity

Addressing the Bottlenecks of FEA Simulation:

*Enabling Innovation by
Getting Even More Value
from CAE*



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***This summary is an abbreviated version of the report and does not contain the full content. A link to download the full report is available on the Tech-Clarity website, www.tech-clarity.com.**

If you have difficulty obtaining a copy of the report, please contact the author at michelle.boucher@tech-clarity.com.

Executive Overview

As companies seek to improve profitability and competitiveness, investments in the product development process can yield big returns. Empowering teams to make the best design decisions puts them in a great position to bring innovative, high quality, profitable products to market.

Simulation can be a powerful tool for supporting better decisions. However, several steps during the simulation process can slow things down and prevent companies from taking full advantage of potential benefits. Understanding simulation challenges can help companies put the right capabilities in place so they may realize even more value from simulation tools.

Simulation can be a powerful tool for supporting better decisions.

What challenges do companies experience as part of the simulation process? What slows the process down? How do successful companies get the most value from simulation? To answer these questions, Tech-Clarity surveyed over 160 manufacturers about their simulation processes. The results were analyzed to identify the top challenges associated with preprocessing, preparing for the solver, and postprocessing.

The research finds that:

- Preprocessing is the most time consuming part of the simulation process, taking up 38% of total simulation time
- Top challenges of preprocessing include finding problematic geometry, recreating CAD geometry, and defining assembly contacts
- Top challenges of postprocessing involve the time invested in filtering through vast amounts of data

The research also highlights the complexity of the environments in which analysts work. Companies report using 3.6 different CAD tools on average, with 84% using two or more CAD tools. Companies also work with 3.3 different solvers for analyses. This further aggravates the challenges associated with preparing models for analysis.

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Further analysis identified how Top Performing organizations address these challenges. Top Performers are those who are more successful than their competitors. Compared to competitors, they are more efficient, more innovative, produce higher quality products, and do a better job meeting cost targets. Some of the things they do to achieve this

success includes:

- Automating many time consuming, tedious tasks associated with preprocessing. They are twice as likely to automate assembly contact definition and 4-times as likely to automate geometry clean up.
- Maintaining flexibility and control so that models are not overly simplified and mesh size is appropriate. They are 52% more likely to have the ability to edit and control the mesh.
- Using visual filtering and sorting tools to more easily review, analyze, and share simulation results. They are 2.2 times more likely than peers to visually filter results, which allows them to interrogate the results and quickly focus on areas of interest.
- Ensuring their simulation solution works for their multi-CAD environment. They are 89% more likely than their peers to look for a simulation solution that has the ability to work with multi-CAD data.

Top Performers are twice as likely to automate assembly contact definition and 4-times as likely to automate geometry clean up.

In addition to examining the bottlenecks associated with simulation, this report provides guidance on best practices to address them. These practices will help product development teams get even more value from simulation so that they can make the right product decisions that will lead to more profitable products.

Conclusion

To beat the competition, companies need to develop products that are innovative and high quality, yet cost effective. Accomplishing this requires good decisions during development, and supporting design decisions drives many companies to make investments in the design process.

Simulation tools enable companies to efficiently make better decisions about cost and quality. They also guide decision making around experimentation, which leads to greater innovation. However, there are several places that slow down the simulation process and impede overall product development. Looking at tools that improve the efficiency of these areas will enable better decisions.

Best practices used by Top Performers enable them to beat the competition with more innovative, high quality products that meet cost targets.

Top Performing companies have implemented best practices to address many of the top simulation challenges. This helps them get even more value from their investments in simulation tools. As a result, they beat the competition with more innovative, high quality products that meet cost targets. These practices include automating time consuming, tedious tasks associated with preprocessing. They also use visual filtering and sort tools to review and share simulation results. As a result they can make better decisions, more efficiently, which helps them stand out from their competitors. They also look for tools that support multi-CAD data. This gives them flexibility to work with the data in their environment, no matter where it came from including others in the company, legacy data, suppliers, or customers.

Recommendations

Based on industry experience and research for this report, Tech-Clarity offers the following recommendations:

- Invest in the development process to improve innovation, increase quality, and lower cost. This represents the biggest opportunity to differentiate your products from the competition.
- Leverage simulation tools to support goals to make products more competitive. Simulation provides insight into product behavior to not only identify problems early on, but to also understand the impact of trade-offs so that design decisions are better informed.
- Automate tedious and time-consuming preprocessor tasks. This includes defining assembly contact, identifying problem geometry, and common workflows. Preprocessing is the biggest bottleneck of simulation. Automating these tasks will save time so that results are available sooner, more analyses can be done, and companies will realize even more value from their simulation tools.
- Use meshing tools that provide automation as well as flexibility so that mesh size is appropriate. Meshing models is one of the most time consuming tasks of simulation. Automating it will save a lot of time, but flexibility enables options to make adjustments to mesh size when needed. For example, in critical performance areas, a finer mesh may be needed so that more calculations are done in that area for even greater accuracy or areas of little consequence can be given a larger mesh that will take less time to process.
- Balance automated de-featuring with control so that models are not so simplified, analysis results are unreliable. De-featuring is also one of the biggest time sinks for simulation so automated de-featuring will save time, but having some control gives the analyst the flexibility to ensure features, such as tiny edges that create stress points, are not removed from the analysis.

- Reduce the time to evaluate multiple iterations with functions that automate re-meshing a model with new parameters. With some solutions, when the analysis is rerun with new parameters, the mesh must be recreated, which adds time. The option to automatically re-mesh with new parameters means more iterations can be evaluated, without wasting time recreating the mesh each time.
- Use postprocessing tools that make it easier to work with all the resulting data. The top postprocessing challenges are related to the overwhelming amount of data produced during analysis. Tools that make it easier to work with all of this data, such as visual filters and sorting tools, will make it easier to analyze the results.
- Select tools that can work with multi-CAD data as needed. Companies report using 3.6 CAD tools on average which means they need simulation tools that can work with a variety of multi-CAD data.
- Use a vendor who can provide needed support resources. Companies identify the availability of technical support as the most important quality of a simulation vendor. When help is available when it is needed, down time and frustration can be minimized as users can reach out and then move on with assistance from technical support.

About the Author

Michelle Boucher is the Vice President of Research for Engineering Software for research firm Tech-Clarity. Michelle has spent over 20 years in various roles in engineering, marketing, management, and as an analyst. She has broad experience with topics such as product design, simulation, systems engineering, mechatronics, embedded systems, PCB design, improving product performance, process improvement, and mass customization. She graduated magna cum laude with an MBA from Babson College and earned a BS in Mechanical Engineering, with distinction, from Worcester Polytechnic Institute.

Michelle began her career holding various roles as a mechanical engineer at Pratt & Whitney and KONA (now Synventive Molding Solutions). She then spent over 10 years at PTC, a leading MCAD and PLM solution provider. While at PTC, she developed a deep understanding of end user needs through roles in technical support, management, and product marketing. She worked in technical marketing at Moldflow Corporation (acquired by Autodesk), the market leader in injection molding simulation. Here she was instrumental in developing product positioning and go-to-market messages. Michelle then joined Aberdeen Group and covered product innovation, product development, and engineering processes, eventually running the Product Innovation and Engineering practice.

Michelle is an experienced researcher and author. She has benchmarked over 7000 product development professionals and published over 90 reports on product development best practices. She focuses on helping companies manage the complexity of today's products, markets, design environments, and value chains to achieve higher profitability.

About the Research

Tech-Clarity gathered and analyzed 160 responses to a web-based survey on designing and simulating products. Survey responses were gathered by direct e-mail, social media, and online postings by Tech-Clarity and Desktop Engineering.

The respondents were comprised of 46% who were individual contributors. Another one-third (32%) were manager or director level, and the remaining 22% from VP or executive levels.

The respondents represented a mix of company sizes, including 32% from smaller companies (less than \$100 million), 20% between \$100 million and 25% greater than \$1 billion. 23% chose not to disclose their company size or did not know it. All company sizes were reported in US dollar equivalent.

The responding companies were a good representation of the manufacturing industries, including Industrial Equipment and Machinery (30%), Aerospace and Defense (20%), Automotive (18%), High-tech and Electronics (15%), Life Sciences (14%), Consumer Products (9%), and others. Note that these numbers add up to greater than 100% because some companies indicated that they are active in more than one industry.

The respondents reported doing business globally, with most companies doing business in the North America (85%), about one-third doing business in Western Europe (32%), Asia-Pacific regions (27%), Eastern Europe (10%), Latin America (13%), and Africa (5%).

Respondents not directly involved in designing and/or manufacturing products were excluded from the analysis.