Finite Element Analysis

The Right Partner Can Bring FEA Design Simulation Within Reach of Any Manufacturer

IMAGINiT Technologies equips your team with the knowledge to bring structural analysis capabilities in-house, or can share expertise as a trusted extension of your team.

From the editors of cadalyst Sponsored by IMAGINiT TECHNOLOGIES
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In today’s fast-paced, competitive market, manufacturers can use every possible advantage. This is especially true during the product development phase, where decisions and timelines can significantly impact quality, cost, and time to market.

For decades, technology use has been critical for manufacturers that strive to distinguish their products and outpace the competition — that reality becomes increasingly true with each passing year as new technologies enter the landscape and old technologies improve and become more affordable. One such tool is Finite Element Analysis (FEA), a branch of design simulation that analyzes structures to help optimize product performance with greater confidence and expediency.

Once beyond reach of all but the largest product developers, FEA today is more affordable and less complex to learn and use than it was even a few years ago — however, it hasn’t yet reached the realm of easy or inexpensive. Small and medium-sized businesses (SMBs) are recognizing the value of FEA, but not all have the resources to tackle it alone. That’s where a great consultant comes in: The right partner can support an SMB in its efforts to tap the benefits of FEA while avoiding drawbacks.

This white paper discusses the FEA consulting and training services of IMAGINiT Technologies, the world’s largest provider of enterprise solutions to the engineering community, and how SMBs of all shapes and sizes can partner with IMAGINiT to gain an important edge in today’s market.

What is FEA and How Can It Help?
Finite Element Analysis is a computational method of optimizing structural design. FEA software digitally analyzes materials or objects to determine the effects of real-world stresses such as vibration, heat, fluid flow, and other applied forces and identify points of weakness. Manufacturers of all sizes use FEA to:

- assess design performance before making tooling commitments;
- increase design efficiency and product reliability;
- optimize performance-to-weight ratios; and
- optimize overall performance goals without sacrificing size, cost, or aesthetics.
By providing data that validates how a product will perform in the real world, FEA can help to mitigate under- or over-engineering; reduce design redundancy and rework; meet specifications with fewer design iterations; reduce exploratory physical prototyping without sacrificing confidence in design performance; and substantiate performance claims.

These benefits in turn can result in improved:

- **industry compliance** by efficiently verifying product performance;
- **product differentiation and brand recognition** by supporting development of superior-quality products delivered ahead of the competition and ensuring how they will perform in the field;
- **time to market** — for example, by reducing or eliminating physical product testing; and
- **cost control**, thanks to reduced materials use and product size and weight, lower testing costs, improved product performance and reliability, time savings across the product lifecycle that can lead to lower product development costs, reduced warehousing and shipping costs, and reduced product failure rates, to name just a few examples.

Hunter Norrgard, Senior FEA Simulation Specialist at IMAGINiT, shares an example wherein FEA was used in the redesign of a fermentation tank. The original wall thickness — commonly used in the market but found to have a safety factor 15 times greater than industry requirements — was significantly reduced to save materials and product weight (and therefore shipping costs) while still achieving a safety rating well above the limits.

In another example, FEA is tapped for DDAM (Dynamic Design Analysis Method) testing, a procedure developed by the
U.S. Navy to evaluate the design of equipment subject to dynamic loading caused by underwater explosions. Traditionally involving barges that are subjected to detonated dynamite with costs into the six-figure range, Norrgard says, “Using FEA we can run a similar type of shock test simulation based on DDAM that’s an order of magnitude less expensive and without destroying any equipment.”

**FEA Services from IMAGINiT**

IMAGINiT’s simulation team helps organizations tap the benefits of FEA, whether customers aim to develop in-house FEA expertise or outsource the process to IMAGINiT experts. Norrgard explains, “There is no one-size-fits-all solution, no single FEA or software package or service that will be the magic bullet for everyone.”

So IMAGINiT tailors services to the needs of each client. “Even if a client or project requires something very specific, we can deliver,” Norrgard continues. “We want to become a truly trusted resource for our customers and set them on the right path. We want to build trusted relationships.”

Companies that wish to bring FEA in-house can choose from two types of training services, which can be offered at the customer’s site, or IMAGINiT training locations, or online.

**Standard training courses** are based on the official Autodesk courseware for a particular FEA software product, such as Autodesk® Nastran® In-CAD or Autodesk® Inventor® FEA. IMAGINiT’s sister company, ASCENT, along with the guidance of IMAGINiT’s simulation team, creates the official Autodesk Courseware for all standard Autodesk software training, whether offered by IMAGINiT or other providers.

**IMAGINiT’s customized implementation program** is an application/project–based knowledge transfer program that teaches the software and related workflows based on a customer’s actual project. Incorporating training best practices, it centers on the features, functions and workflows specific to the customer’s unique analysis needs for flatter learning curves and faster ROI within the design process. The result is training that resonates strongly with users, Norrgard says, getting them up to speed quickly with their new software — and they end up with a real-world deliverable. As part of this program, FEA users get direct access to the IMAGINiT simulation specialist who trained them to ensure solidification of topics learned and proper application to real development work.

Why is FEA training important? Learning from the experts helps companies avoid the inefficiency, incorrect software use, and inaccurate results that are common when going it alone. IMAGINiT passes along the best workflows for specific project types as well as the technical knowledge needed for success, based on its experience with diverse projects over the years.

**FEA simulation services** are available for companies that don’t wish to do FEA themselves or are simply short-handed but still need the benefits to make informed design decisions. IMAGINiT experts step in to conduct Finite Element Analysis on the customer’s design, delivering the results and recommending design modifications.
FEA expertise is not needed on the client side — IMAGINiT provides the software, knowledge, best practices, and experience required to produce a fully optimized design.

Through its FEA services, IMAGINiT helps organizations understand how to fix a problem or innovate new and better performing products without diverting internal engineering resources. Team members have decades of knowledge and experience running and interpreting FEA, which supports clients in making informed design decisions and meeting project deadlines. The process is highly collaborative, calling on the strengths of both IMAGINiT and its clients and involving design review meetings to ensure all design and project objectives are preserved.

Norrgard describes how some services providers inundate clients with data that results from FEA work — data that is meaningless without extensive FEA expertise and interpretation. By contrast, IMAGINiT provides reports of only the relevant data along with data interpretation and recommendations. “Most of the time, our customers are not looking for high-level technical information. They want real-world information that helps them move forward. We give them exactly what they need, in terms that make sense.
“For example, we show where a material is being most strained and the root cause behind that,” Norrgard continues. “We can show that by offering a visualization, taking snapshots of most severe deformation or stress response in the design, plus a few key data points and corresponding commentary — as opposed to 30 pages of data that isn’t practical information.

“We have a lot of tools at our disposal, and we believe strongly that there’s a right tool for every job,” Norrgard says. “Using a variety of software, we can deliver what’s best for a given project.”

**Who Can Benefit**

Any product developer or manufacturer can benefit from an IMAGINiT partnership, Norrgard says. Although most FEA customers’ needs involve some sort of machine design or metal fabrication, “we work with companies that make anything — hydraulics, medical devices, we’ve seen and worked with everything.”

IMAGINiT clients can use any design software, and the team works on rare occasion with clients who do not have any design capabilities (or software) in house, Norrgard notes. “The bottom line is we have a variety of tools at our disposal, and a lot more invested in our services than in any given software product.”

Clients range from one-man shops to very large manufacturers. “We work with the biggest aerospace companies providing training and other support, but most customers are small to
midsize,” Norrgard says. “They recognize the value of analysis but don’t necessarily have the in-house expertise to address the challenges.”

Many IMAGiNiT clients start out thinking they don’t have the time or budget to add analysis to their workflows, but quickly come to understand that the long-term benefits of FEA far outweigh the initial drawbacks. For example, Norrgard explains, “If you need to do any type of validation through physical testing, you are always setting yourself up to have to do that over and over” and not only pay the price repeatedly for the physical testing itself but also for the wasted time. In the previous fermentation tank example, Norrgard says, adding FEA to the development process saved significant money through reduced materials use. “Our expertise in Nastran In-CAD was used to demonstrate how these tanks could be redesigned with a thinner wall thickness, saving thousands in production costs without sacrificing quality or load bearing.” In this case, “the risk of taking a little extra time to get to market is more than worth the extra time required to reap the potential benefits.”

**Value and Cost**

According to IMAGiNiT, the cost justification for FEA usually comes from the fact that non-optimized designs generally leave money on the table, lack of simulation results in non-compliance of a code or standard, or field failures result in costly retrofits or litigation.
Are FEA services expensive? Says Norrgard, “IMAGINiT has been successful in developing a scope of work that fits within our customers’ budgets without sacrificing quality of work or attention to detail. We find a way for everyone to walk away satisfied.”

Unlike that of many other providers, IMAGINiT’s FEA services pricing model utilizes a flat rate to control cost overruns. Based on the team’s extensive experience, “we know what’s involved and don’t charge extra after the fact, so there are no surprises [for the customer]. In other words, they are signing up for a solution and not hours.”

Training cost. IMAGINiT’s standard FEA software training is a fixed price per student enrolled. Knowledge Transfer custom training is priced similarly to a typical services project (based on level of effort) and does not reflect the number of students.

Services cost. When companies outsource FEA to IMAGINiT, pricing is based on analysis type, model complexity, level of data gathering and reporting, and the desired schedule for the project.

**Summing Up**

Why do customers choose IMAGINiT for FEA consulting? In addition to recognizing the long-term value of adding FEA to the product development process, the decision comes down to trusting IMAGINiT as a partner that will deliver tailored services at a fair price. Not all consulting services are created equal; IMAGINiT’s FEA experts are dedicated to delivering all the benefits of FEA without the drawbacks and are fully invested in their clients’ success.

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