ESI Extends the Vision of the Virtual Prototype

CIMdata Commentary

Key takeaways:

- *ESI provides a vision of a "virtual prototype" that is comprehensive and includes manufacturing*
- *ESI is a leader in the capabilities of its solutions for manufacturing simulation*
- *End users are looking to ESI for simulation capabilities that include "as-manufactured" material properties and accurate representations of welding, bonding, tribology, and other manufacturing concerns*

While many PLM software companies promote digital models or virtual representations for accelerating new product development, ESI has a comprehensive vision of a "virtual prototype" that minimizes or even replaces physical prototypes and testing across the span of conceptual product engineering; detailed design development and validation and; perhaps most unique, design simulation for materials selection and manufacturing optimization.

With growing product complexities and the need for faster innovation, the product lifecycle process and organization reached its limit with inherent major drawbacks. ESI envisions a more holistic, next generation product lifecycle, not simply one in which digital modeling and simulation replaces isolated steps in the usual way of doing business.

ESI envisions simulation across a broader span of the product lifecycle, reaching to the "as built" rather than "as designed" product.

Dr. Alain de Rouvray and others founded ESI in France in 1973. The company was made public in 2000. ESI developed PAM-Crash for automotive crash safety simulation and, in 1986, conducted the first full-vehicle frontal crash simulation, using a model of a Volkswagen Polo. With the development of PAM-Stamp, ESI became a leader in the simulation of metal forming processes used in automobile manufacturing. Today, ESI has a broad portfolio of solutions for product performance *and* manufacturing process simulation. This allows for upfront deep understanding of the cause and effect relationship along the value chain, that guides reliable decision-making and avoids a long ramp-up phase and costly late design changes.

As an example, ESI's Virtual Performance Solution provides a platform based on a single core model for multi-discipline simulations and multi-domain optimization. Applications include structural stiffness and strength, crash, occupant safety, NVH and interior / exterior acoustics, comfort, durability, and high velocity impact.

Additional tools simulate manufacturing operations (casting, composites, sheet metal forming, welding, and assembly). Simulation of physics domains like fluids, thermal, chemistry, and electromagnetics are available and may be coupled with each other and with structural simulation to solve multi-physics problems.

ESI also offers a high-end virtual reality solution, IC.IDO which is extensively used by major companies for collaborative and immersive design reviews, to evaluate and optimize assembly and disassembly sequences, to verify resources and tooling for both manufacturing and maintenance, and to visualize physics-based simulations. A heavy equipment manufacturer has full-scale immersive virtual reality (VR) facilities at its product engineering sites, where they focus on a few "high-value" applications that include ergonomics and operator visibility. These facilities use ESI VR tools. This end user stresses the importance of full scale for VR, and notes that these facilities are supported as part of their regular production IT systems and network.

Many companies have a goal for a completely digital product development process. They want complete digital descriptions of all aspects of their products, including models of product behavior. VW Group, for example, calls it “Simulation based Front loading.”

Simulation and analysis (specifically CAE) can, of course, be used to assess design performance. If the simulation is reliable enough, there is the possibility of a “virtual prototype,” which is an end-to-end digital process that does not require physical prototypes or development testing.

The virtual prototype is only feasible if a company has high confidence in their own capability. In other words, virtual prototyping is as much about process as it is about software tools. Every company has to develop their capability to their own satisfaction. It is not something that can simply be purchased off the shelf and deployed.

Companies, particularly those in the automotive industry, are making good progress. Product development times are much shorter, and physical prototype builds have been greatly reduced, or even eliminated. For some load cases, they have reached the goal of the completely virtual prototype. To do this requires an investment in developing a robust, repeatable, and reliable capability for simulation.

CIMdata has observed that industrial companies often work with their software suppliers to develop this capability. Some of this is software development; some of it is the methodology with which the software is applied.

The essential point here is to improve an organization’s engineering capability. Prototypes take too much time to create and test, are expensive, and are often not representative of the “as produced” product. The optimum engineering process (at a point in time) includes an appropriate mix of test and simulation. In time that balance will shift towards simulation as it gets better, faster, and cheaper, while physical testing does not.

Unfortunately, the goal of simulation is often presented as being to replace testing, particularly in large companies, where simulation and testing are separate functions—which creates tension and competition. Simply put, the CAE department’s proposition is “buy bigger computers for us and cut the budget for testing.” As a result, the test department campaigns against the reliability of simulation, and overall progress to a better, more reliable engineering capability is the casualty.

There is a persuasive argument that simulation and testing should leverage each other and be part of a flexible process for efficient product performance validation. ESI is implementing solutions that support this vision.

Established space launch systems companies like United Launch Alliance (Boeing plus Lockheed Martin) and Airbus (Arianne) are now threatened by commercial competition from newcomers like Space-X. For a new space launcher there is no possibility for development testing and at most one launch test to prove the product before commercial operations begin. This means also that there is no opportunity to develop or “industrialize” manufacturing systems. They need to produce a viable product from the start.

ESI’s customers share their vision. They paint a picture of a PLM-enabled model-based environment where functional assessments include as-manufactured material properties and factors like welding, bonding, damping, tribology (lubrication and friction), fatigue, durability, and damage tolerance. They are looking to ESI to help them “get it right” the first time.

CIMdata agrees with this vision of a comprehensive, model-based approach to full product simulation. ESI’s strengths in traditional mechanical simulation and in manufacturing process simulation position them to deliver on this vision.

About CIMdata

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