

Smart manufacturing: Reducing costs through virtual simulation

Recognising optimisation potential in product development and implementing in the manufacturing process

Smart manufacturing is the fully integrated, collaborative manufacturing systems that respond in real-time to meet changing demands and conditions in the smart factory, supply network, and customer needs.

Today's competitive market has created a highly challenging environment for product development. Companies are under increasing pressure to sustain their competitive advantages by reducing product development time and cost while maintaining a high level of quality. These needs drive companies to focus on developing a well-coordinated development plan to organise their processes and resources.

The development and production planning departments are responsible for up to 90% of the lifecycle costs of a product. Sadly, this occurs at a

point where the component does not physically exist yet. Thus, it is necessary to take all measures to enable robust, error-free, and economical production early in the design stage. The use of numerical simulations plays an important role here: virtual computer simulations replace physical testing of products or processes, which drastically reduces the production costs of prototypes. In addition, they improve product quality by reducing product development and delivery times through analysis and validations on the virtual model.

Simulation is now a natural part of the design process, saving development time, reducing physical prototyping costs, and improving the product quality. Further, by saving development time through simulation, the design team can spend more time innovating. Product design teams use simulation

to develop and test hundreds of virtual product iterations, making simulation part of the design process itself.

For successful product manufacturing, it is critical to perform virtual manufacturability analysis and simulations of the production process. Studies show that 33% of engineering change orders (ECOs) to the product or production process are due to manufacturability concerns. Finding these ECOs early in the design phase substantially increases engineering efficiency and dramatically reduces time and cost.

To fully develop the manufacturing process, a large number of simulation tasks are required. By using specialised tools for each development step, the development implementation is efficient and cost-effective. Hexagon connects the previously

isolated engineering disciplines from design to manufacturing to the final quality inspection.

Hexagon's FormingSuite software provides solutions for early feasibility assessment and cost calculations for Body-In-White (BIW) sheet metal parts. Used in the early stages of product development, it empowers designers to determine and understand the material and manufacturing costs associated with their design enabling components to be produced cost-effectively, eliminating geometrically caused cost drivers. The simulation also addresses potential problems with manufacturability by identifying formability issues early in the design process. Simulation allows the designer to design the component first-time-right. Designers can analyse the component's manufacturing feasibility, optimise the geometry, and avoid costly design changes later in the manufacturing process.

Hexagon's Simufact Forming, Simufact Welding, and Simufact Joining simulation software enable virtual production testing. Traditional approaches involve a mixture of experience and trial and error testing. With smart manufacturing, the more complex the manufacturing process is, the higher the potential for cost savings. Optimisation of your manufacturing processes improves production maturity, increases quality, efficiency and reduces costs.

Simufact Forming allows for the design and optimisation of all forming production processes in metalworking and metal processing. Simufact Welding predicts welding stresses, distortions, and the evolution of material properties and helps determine strategies to minimize these risks. Simufact Joining simulates the mechanical interlocking of differing materials.

Customers from the bulk metal forming industry rely on process simulation to reduce the number of physical testing by up to 50%. They experience reduced development

times for new components from three weeks down to one week. With process simulation, they immediately have answers to questions such as forging defects, die forces, or die life thus reducing or eliminating physical tests. With virtual testing, manufacturers can identify and avoid critical factors earlier.

Hexagon's Digimat software provides an accurate simulation of fiber-reinforced plastics. Digimat minimizes lead times and development time for engineered materials. For example, the classic development time for a component that dampens the vibration of an automobile is around 18 months – with the first 16 weeks devoted to design and process development. Utilising Digimat to precisely simulate material behavior eliminated prototypes which significantly shortened the development cycle by 70%.

Industry 4.0 describes a digitally networked working environment along the entire value chain. For this reason, Hexagon is currently working on the implementation of a strategic solution platform within the framework of smart manufacturing: Virtual Lifecycle Manufacturing (ViLMa). Virtual Lifecycle Manufacturing achieves further cost savings and quality improvements through a combination of different software solutions. The targeted use of production simulation solutions in the early development stages plays a central role.

Traditionally, quality inspection data can only be evaluated and analysed after prototypes are built or after production has started. With Virtual Lifecycle Manufacturing, virtual inspection data is generated from the production simulation using intelligent software solutions and processed and analysed using the same methods and in the same data and quality management system as physical measurement values. To complete the Digital Twin, physical inspection data can read enabling

a direct comparison with the virtual measurement parameters and the nominal CAD data due to the uniform evaluation logic and analysis.

All virtual measurement data from the simulation and the physical measurement data is recorded, analysed, and documented in the integrated solution platform. This extensive collection of data provides the basis for developing simplified models with artificial intelligence (AI) or machine learning (ML) to quickly obtain information and feed it back into the process.

Integrating simulation with manufacturing, or smart manufacturing is part of the move toward bringing simulation into the heart of the product development process. Integration between different processes and tools is vital to increased productivity and efficiency. Simulation linked with a data center backbone gives manufacturers a single nerve center for their global operations. If anything changes at any point, everyone is notified, and you don't have to switch from application to application. It will get newer designs and technologies into your customers' hands quicker and improve your bottom line.

Hexagon enables companies to digitally transform their manufacturing processes, seamlessly connecting data throughout the process and converging the real and digital worlds to drive continuous improvement. Hexagon's Manufacturing Intelligence division provides solutions that utilise data from design and engineering, production, and metrology to make manufacturing smarter.

Download the Smart Manufacturing Whitepaper- Reducing costs through virtual simulation: www.mscsoftware.com/smart-manufacturing-whitepaper