An optimal manufacturing process for automotive components is essential for the quality and the cost efficiency of these components. This is the reason that automotive suppliers have increased their use of simulation tools: simulation allows manufacturers to plan the process in detail, to save material or increase equipment productivity.

Tekfor Cologne, a company of the Neumayer Tekfor Group, develops and produces automotive components and assemblies at its plant in Cologne, Germany, including transmission, engine, driveline, fastener and chassis products. These products are manufactured by different methods, mainly warm forming/cold forming and ring rolling/wedge rolling.

All part design, development and production process planning is carried out by Tekfor Cologne engineers. This
Jürgen Schüler, head of engineering for Tekfor Cologne, “because it will get critical if we don’t look into the forming process before the production starts.”

Simufact.forming is the integrated simulation environment that makes it possible for Tekfor Cologne to avoid cost-intensive testing on real machinery, as well as the product aberrations that consume time and money.

The design of a “normal” process development often starts with a customer’s inquiry and a corresponding detail drawing of the requested component. On this basis, a blank-component drawing is made. Measures, edge conditions and material are specified.
At this stage, a first concept review is done to determine whether the component can be formed as desired. The cost is calculated after finishing the blank-component drawing. This includes the calculation of the required material, the selection of the machines and a calculation of the respective machines’ hourly rates. Tekfor Cologne usually has enough experience to provide an estimate without or with very little simulation for standard inquiries. This is, however, different for inquiries that present a real manufacturing challenge. In these cases simulation is used to get detailed information about the press forces and to evaluate whether the selected forming process is realizable.

Process simulation is used very early during an offer calculation, even before the first part is forged. This leads to a significantly improved process understanding, without even starting a machine or using material.

**COMPARING VIRTUAL AND REAL TESTING**

Data shows that the costs for developing a process layout without process simulation are about 10 times higher than for one with process simulation. For a definition of the optimal process through real testing, various staff members and expensive machine hours would be needed – possibly multiple times – until the perfect process can be defined. In addition, no production is possible on a machine while the testing is underway. A comparison with the initial and the running costs of a simulation workstation shows, in most cases, that the investment in virtual tools have amortized after just one project.

The simulation also affects finished product quality for Tekfor Cologne. The company develops and supplies high-value components for the automotive industry, and with the help of Simufact.forming it is able to design and produce much more complex components than it had done previously. While the company has been developing and supplying automotive components for many years, some of the RFOs that it found too demanding to execute five or six years ago can be systematically designed and realized now, using simulation software, and at minimal risk.

If there are any difficulties with problematic components, especially in a running serial production, Tekfor Cologne can resort to the know-how of Simufact Engineering GmbH — including complete outsourcing for calculations. The insights they gain are used to eliminate faults in the serial production and to avoid them in future projects.

**THE PERSPECTIVE**

Tekfor Cologne plans to increase its ring rolling and wedge rolling simulation activities in the near future. These applications have the greatest potential for cost reduction for the company, because the projects usually are very complex. Linking the single forming stages is especially difficult here. The simulation helps to realize these projects better and more cost-efficiently. In addition, improvements can be made to all other forming processes at the operation. This will show new ways to simplify the planning process and to make the processes more economic and predictable.

Schüler said that an important factor in Tekfor Cologne’s selection of Simufact.forming was that it could be used by “non-experts” to conduct finite element analysis (FEA), because of the user-friendly graphical interface. “We reached a situation in which we achieve a 90-98% match between the real product and the virtual layout, based on a combination of experienced staff and simulation,” he reported.

He maintains that product engineering is no longer possible without using forming simulation. Critical product design details can be recognized early, feasibility studies can be done without using real prototypes and, more often than not, cost reduction can be achieved for running production. Together Simufact Engineering and Tekfor Cologne plan to continue working together, expanding the capabilities of simulation technology for practical use.

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