

CHALLENGE:

Quality and Cost-Efficiency for the Serial Production of Automotive Components

SOLUTION:

Virtual Process Layout through Simulation

PRODUCTS USED:

Simufact.forming

CUSTOMER:

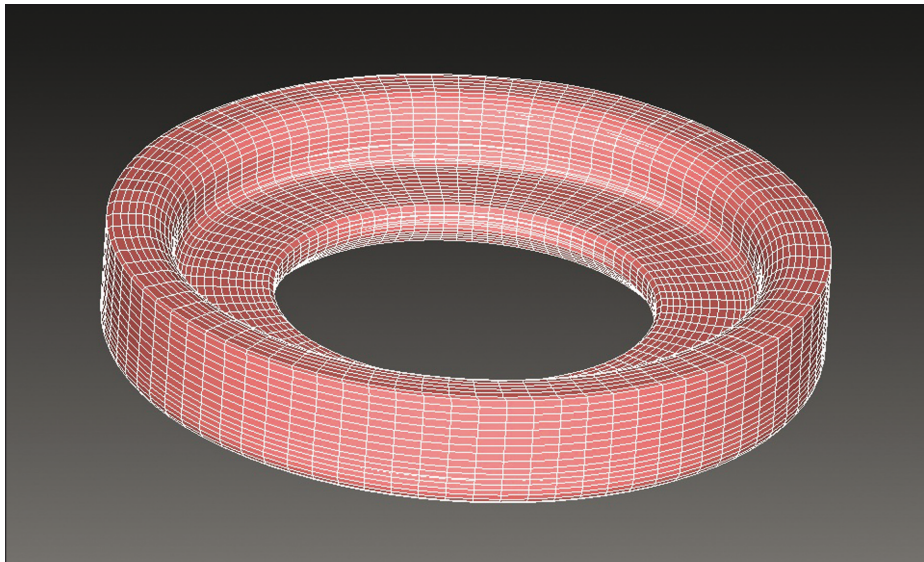
Neumayer Tekfor Holding GmbH



The Ring Rolling Component is Pre-formed in Three Stages and then Formed Radially and Axially in an Interlinked Machine Assembly

Forming simulation in the automotive industry – quality and cost efficiency at Neumayer Tekfor

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Simulation Model of a Component for a Differential Gear (Front-Wheel Drive)

An optimal manufacturing process for automotive components is essential for the quality and the cost efficiency of these components. This is the reason why the use of simulation tools prior to the production has increased. With simulation, the process can be planned in detail to save material or increase the uptime of the machines.

Introduction

Neumayer Tekfor Holding GmbH develops and produces components and assemblies for the automotive industry at their plant in Cologne. The product lines are divided into Transmissi-

on, Engine, Driveline, Fastener and Chassis. The products developed and produced at Neumayer Tekfor are manufactured with different methods, mainly warm forming/cold forming and ring rolling/wedge rolling. The engineering department is responsible for planning the complete development and production process of the components, from cost calculation and bid proposals, the decision on the manufacturing method, tool construction, selection of suppliers and raw material, simulation and process layout to the start of production.

Virtual process layout

To meet these requirements, Neumayer Tek-

for utilizes the most recent simulation technology for the virtual design and optimization of forming processes. A strong cooperation with Simufact Engineering GmbH, Hamburg, exists for the simulation of ring rolling and wedge rolling. Besides engineering services, the software supplier and development partner offers a tool for the preliminary analysis, evaluation and optimization of the planned forming process with its simulation environment, Simufact.forming. Cost-intensive tests on real machines and aberrations can be avoided by using the software.

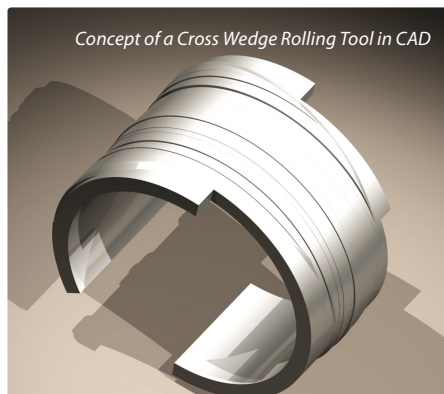
Development process – from inquiry to product

The design of a “normal” process development often starts with a customer’s inquiry and a corresponding detail drawing of the requested component. Based on this, a blank-component drawing is made. Measures, edge conditions and material are specified.

At this stage, a first concept review is done with which it is clarified 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 machine hour rates. The company 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 the 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

"Forming simulation is essential for us, because it will get critical if we don't look into the forming process before the production starts. The analysis and optimization of our complex processes is only possible with a partner that reacts to the customer's need and is willing to implement ideas for improvement within the shortest time possible. We found such a partner where the customer is in the focus with Simufact. A product is good if the user is satisfied."

*Jürgen Schüller, Head of engineering,
Neumayer Tekfor Holding GmbH*



Concept of a Cross Wedge Rolling Tool in CAD

"An important aspect in the decision-making process was that the Simufact tool is the only one that can also be used by non-experts for FE because of the user-friendly and easy-to-use graphical interface. The cooperation with our technology partner Simufact has developed over many years, especially when it comes to ring rolling. 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."

*Jürgen Schüller, Head of engineering,
Neumayer Tekfor Holding GmbH*

an offer calculation, even before the first part is forged. This leads to a significantly improved process comprehension, which can be achieved without even starting a machine or using material.

A comparison of virtual and real testing

If the costs for a process layout with and without

critical to realize 5-6 years ago can now be systematically designed and realized with the simulation at minimal risk.

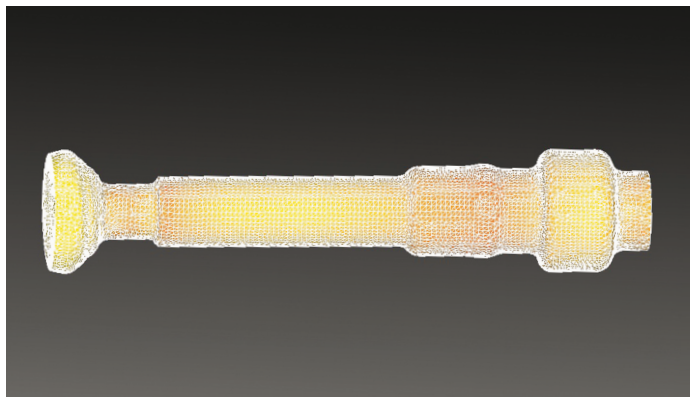
The technology – a development partnership between Tekfor and Simufact

If there are any difficulties with problematic components, especially in a running serial pro-

duction, Neumayer Tekfor. This will show new ways to simplify the planning process and to make the processes more economic and predictable.

Conclusion

In summary, it can be stated that engineering is not imaginable without the utilization of forming simulation anymore. Critical areas at the pro-



Simulation Model of an Output Shaft of a New 6-gear Transmission



After Inductive Heating to 1240 Degrees, the Component Is Formed on a Cross Wedge Roll

duct process simulation are compared, a 1:10 ratio will be the result. 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 could be defined. In addition, no production is possible on the machine during the testing time. A comparison with the initial and the running costs of a simulation workstation shows that in most cases, the investment in virtual tools have amortized after only one project.

The simulation also affects the product quality at Neumayer Tekfor. The company develops and supplies high-end components for the automotive industry for many years now. With the help of the simulation, the company is able to design and produce much more complex components than before. Inquiries which were too

difficult to realize 5-6 years ago can now be systematically designed and realized with the simulation at minimal risk. The service includes complete outsourcing of calculations. The gained knowledge is used to eliminate faults in the serial production and to avoid them in future projects. This kind of co-operation has been established over the years and brings a mutual gain of knowledge.

The perspective

Neumayer Tekfor will increase its ring rolling and wedge rolling simulation activities in the next one or two years. These applications have the biggest cost-reduction potential for the company, because the projects are usually very complex. Linking the single forming stages is especially difficult here. The simulation helps to realize these projects better and more cost-efficient. In addition, improvements can be made to all other forming processes at

Neumayer Tekfor. This will show new ways to simplify the planning process and to make the processes more economic and predictable. duct 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 because of Simufact. Together with the software partner and technology partner Simufact Engineering GmbH, Neumayer Tekfor will expand the simulation technology and make it ready for practical use.