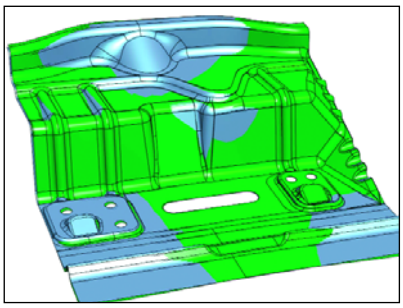

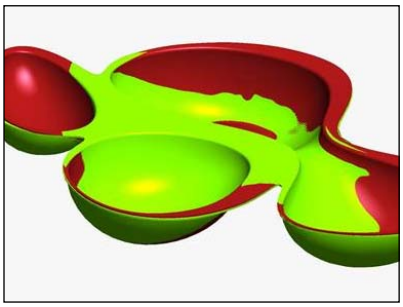
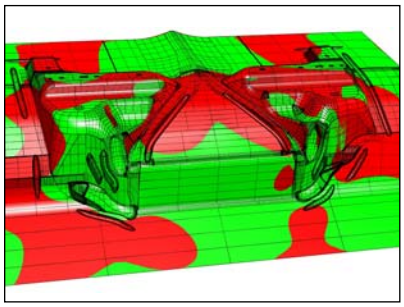

think3®

thinkcompensator

Technical Information

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think3®

Overview/Market

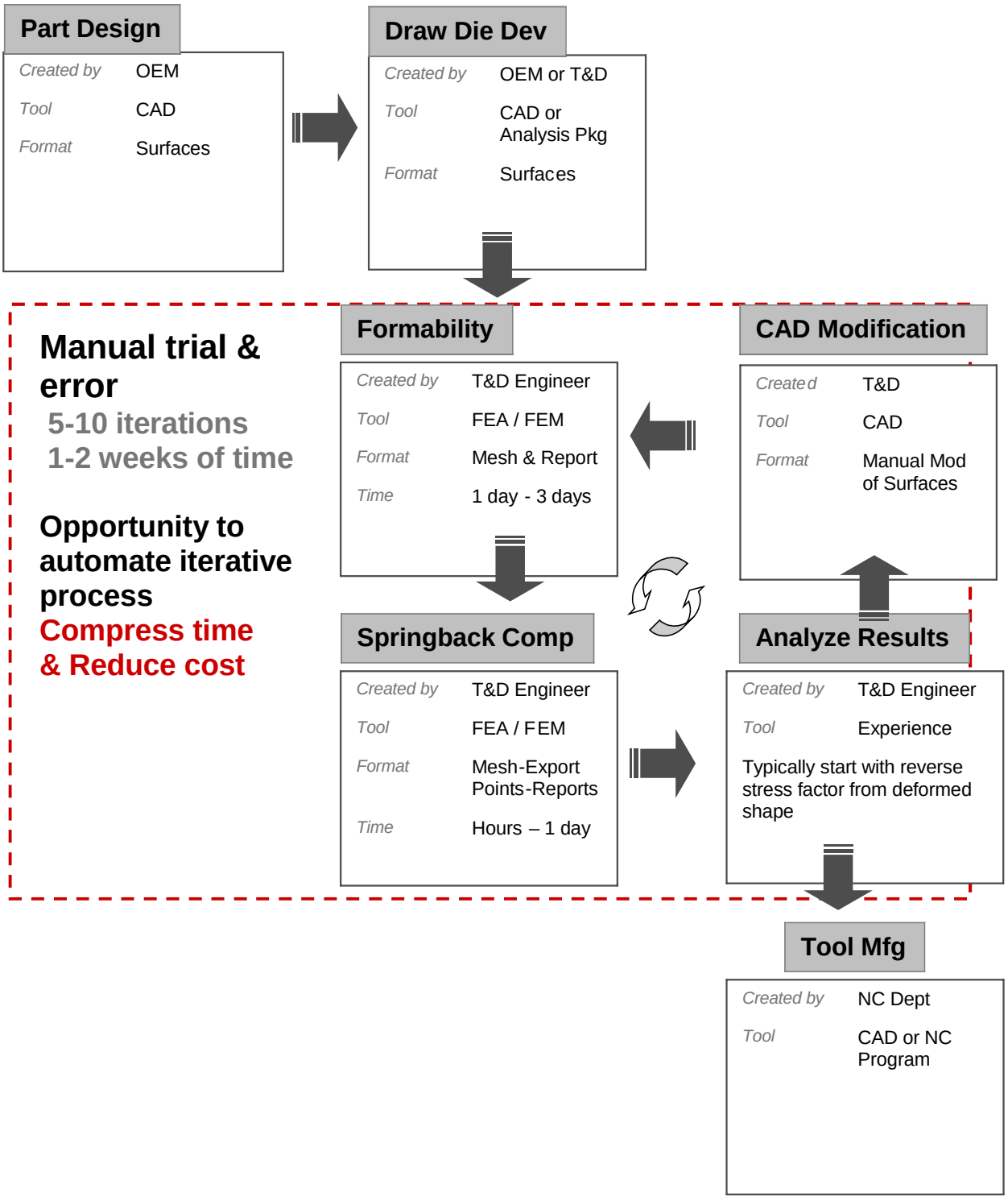
Automotive OEMs and suppliers are facing increased international competition. Therefore, product cycle times must be shortened and the speed to market improved. Additionally, these efforts lead to an increased number of automotive models on the market.

At the same time, customers are demanding vehicles with less fuel consumption and weight. To meet these requirements, an increased use of high strength steel and aluminum alloy is employed, along with the use of more complex parts.

Unsolved problems in sheet metal stamping

Due to elastic deformation of the sheet metal, there is always a certain amount of “springback” when the forming tools are removed. This springback effect increases when using high strength materials. Several techniques (such as smaller radii or draw beads) are used to reduce this effect, but cannot solve the problem. The only method to reach the desired shape is to design tools with different geometry than the "target," or intended, shape.

In the current process, an FEA springback analysis is typically made on the basis of a CAD surface model. The result of the analysis shows the effective position of the object after the forming tools have been removed—the springback effect. Currently, the meshes must be cut in several pieces and single control points "copied" into the CAD model. To create new surfaces from these "point clouds," reverse engineering is required. This process is very time consuming, relies on the user’s experience and the "trial and error" principle. This process may also require more than one physical prototype.



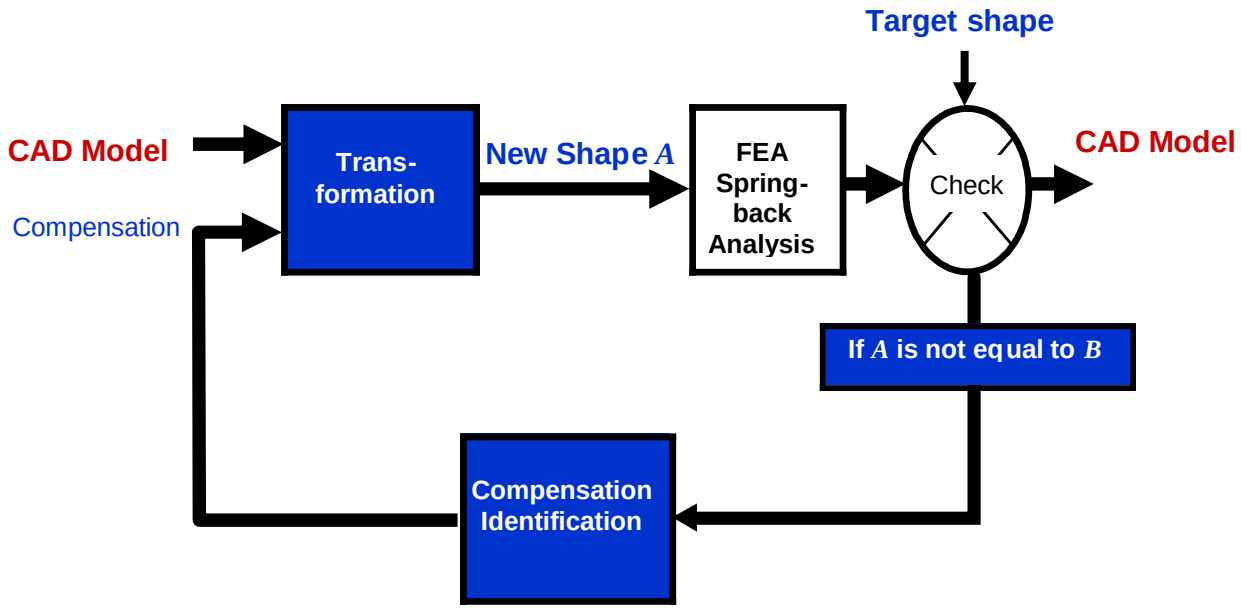
Example of a current, time-consuming compensation process.

The think3 solution

thinkcompensator can import several native CAD data formats, i.e., CATIA V4 and V5, UG. After the FEA analysis of the springback effect, thinkcompensator compares the CAD model with the results of the analysis. If these two shapes are not congruent the command "compensation identification" is applied, which calculates the compensation. On the basis of this calculation the command "transition" creates the new CAD model. think3's Global Shape Modeling technology automatically creates the new surfaces that then reflect the compensation. The quality and topology of the initial and end surface are identical (this is also true for Class A surfaces).

This is not a reverse engineering process. Automotive engineers can spend months defining final Class A surfaces for new cars. think3 has chosen to avoid reverse engineering in a process that can lead to corruption of the final surface quality. thinkcompensator compensates the springback (or other process deformations such as shrinking and warping) deterioration of the data quality.

Since the computation of a single cycle is very fast, it is easy to loop this solution with any FEM software on the market.



Example of compensation process. The process ends when the CAD model and the FEM calculation are congruent.

Benefits

A significant benefit of this new technology is that, as a result of this process, a CAD surface model is created automatically and maintains the same surface structure (topology) as the original model. This enables the standardization and repeatability of the process. The output data is compatible with BREP solid modelers, and the continuities of all surfaces are maintained. All analysis tools (quality verification, distance verification, display/edit of the displacement field, color maps) are available. The model can be directly used for manufacturing. Compared to a manual process. this is a tremendous time savings.

Summary

thinkcompensator helps to automate and standardize the product development process. Optimizing simulation, using thinkcompensator can reduce the number of physical prototypes necessary during the process. Development costs are lowered and the time to market can be significantly accelerated.

The engine of thinkcompensator can be tuned via a standard API-COM interface. Customers can even apply thinkcompensator to other processes, like shrinking and warping, or loop it into other applications.