

# BMW AG

## The Challenge

Established in 1916, BMW is known for sophisticated cars and motorcycles with a sporty touch and a focus on technical innovation. BMW is one of the leading enterprises in the world, and innovation is key. The Aerodynamics Team at BMW AG is responsible for ensuring that the designs of the German car maker's new model have an optimum aerodynamic shape. Additionally, they were evaluating ways to streamline their design process:

- ▶ Accelerate the speed of generating variations in the aerodynamics department
- ▶ Adapt quickly to design variation from FEM analysis
- ▶ Import CATIA data at a very high level, without losing information in the translation

## The Solution

The BMW team purchased multiple seats of thinkiD. "We needed high-performance functions for free form modeling," says Peter Hoff, Head of BMW Aerodynamics Department. During implementation, he was very impressed by the close collaboration between companies; there was complete cooperation between think3 and BMW on technical development work. "At present, in our opinion, think3 is the only free form surface modeler offering this level of functionality and perfection."

BMW selected think3 based on a shared history of product and technical excellence, specifically think3's Global Shape Modeling (GSM). "The starting point in terms of method for GSM was established by the Brite-Euram Project, Fiore I. The objective of this multi-national co-operation project was to enable virtual design modifications to CAS/CAD model without changing specific brand or designer characteristics of the object being modified." Both think3 and BMW were Fiore Project Partners.

## The Story

The Aerodynamics Team at BMW AG is responsible for ensuring the designs of the German car maker's new models have an optimum aerodynamic shape.

The aerodynamics engineer takes a test model into the wind tunnel, measures vehicle aerodynamics, makes changes in the model shape and measures their effect on air flow. "In this series of modifications to the vehicle skin, we use the Global Shape Modeling (GSM) technique by think3 to simulate car aerodynamics in a virtual wind tunnel," says Peter Hoff, Head of BMW Aerodynamics Department.



## Customer Quote

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## Key Results

- ▶ Saved 50% in design time of a specific operation
- ▶ Accelerated the ability to make free-form modifications on the fly
- ▶ Seamless interaction with CATIA data

## Industry

Industrial Design

## Location

Munich, Germany

“Using think3, we have constructed a process chain where the CAD data of the design model are prepared in a specific sequence ready for the flow calculations in the virtual wind tunnel,” says Hoff. “This has made it possible for us to obtain valuable information about air flow behavior straight from the first model tests in the wind tunnel.”

During the process chain the skin, a CAS (Computer Aided Styling) model, is processed and then converted into a triangulated data model. The CAD designer uses thinkiD, the hybrid modeler from think3, to repair the faults. Using Global Shape Modeling, the edges can be shifted while maintaining certain boundary conditions (curve mapping).

The edge transitions, of primary importance to the quality of flow calculations, are finely meshed. This is where think3 enters the picture again. “In the past, for a complete car we needed up to several weeks,” reported Hoff. Now when the design is modified to the development engineers’ specifications after testing, the skin is modified — not the mesh.

The CAD designers use GSM to modify the skin. For example, when an engineer wants to shift the side wall closure by x mm inwards or outwards, a zone that can be modified is defined. The designer can create the new edge and then modify the zone so that the design appearance and a tangential, curved surface path is maintained. This Global Shape Modeling lasts between 10 minutes and half a day, depending on the level of complexity.

think3 with its modern, NURBS based kernel is much more stable and tolerant of imperfect primary surface descriptions than the previously used Euclid Styler. “You can measure the difference also in terms of time. Previously, we were forced to lose one or more day’s work in order to rebuild surfaces simply because the method did not work,” explains Hoff.

Hoff concludes, “The exceptionally good price-performance ratio of thinkiD means that think3 can provide a worthwhile addition to our range of software tools even in a highly monolithic software structure. The remarkably efficient two-way Catia-V4 interface guarantees the general application of the CA system in the BMW Aerodynamics department.”

### The Payoff

- ▶ Accelerated the ability to make modifications on the fly, replacing the complex process of transferring data back and forth between separate measuring and modification tools
- ▶ Associated costs reduced due to time savings
- ▶ Ability realized in adapting design variations from FEM analysis in a short time
- ▶ Achieved full compatibility with other software products; gained ability to import CATIA data at a very high level with think3 translators
- ▶ Ease of learning realized; training requirements were very low

