HyperWorks, especially OptiStruct is one of the central tools supporting the CAE efforts of BASF Engineering Plastics

Overview

Mathematical optimisation methods can provide significant support in virtual CAE part development. In the early phases of the project topology optimisation affords valuable clues to the design of the geometry of the part. Subsequent questions about the precise dimensions can be effectively answered by parameter optimisation runs. The use of morphing methods for this purpose has to be given particular emphasis. The method of mathematical part optimisation employed here really only comes to fruition when the latest software, high-performance hardware and profound engineering know-how are brought together. BASF is continually developing these modern virtual methods to meet the needs of its customers because the company believes that mathematical part optimisation will broadly gain acceptance as the method of choice in the next few years.

Business Profile

BASF is the world's leading chemical company: The Chemical Company. Its portfolio ranges from oil and gas to chemicals, plastics, performance products, agricultural products and fine chemicals. As a reliable partner BASF helps its customers in virtually all industries to be more successful. With its high-value products and intelligent solutions, BASF plays an important role in finding answers to global challenges such as climate protection, energy efficiency, nutrition and mobility. BASF has more than 95,000 employees and posted sales of almost €58 billion in 2007.

BASF Engineering Plastics' design capabilities reside in its Application Development Engineering Group. The Group's primary goal is to provide superior engineering design, simulation, and testing support during all phases of the development cycle. BASF Engineering Plastics employs leading edge technologies and methods in their activities when working in various areas such as: Ideation, Concept Development, Industrial Design, Product Engineering, Tooling Development, Production & Validation.

□ ▪ BASF
The Chemical Company

"A particular advantage of the method is the possible combination of different optimization disciplines as well as the superimposition of different boundary conditions. …no one should do without topology optimisation which can only fulfil its potential when it is employed from the beginning of a development project. If the part has the wrong shape, even the best material is useless."

Andreas Wüst,
CAE Methods and Structural Parts,
Engineering Plastics, BASF
AG, Ludwigshafen, Germany
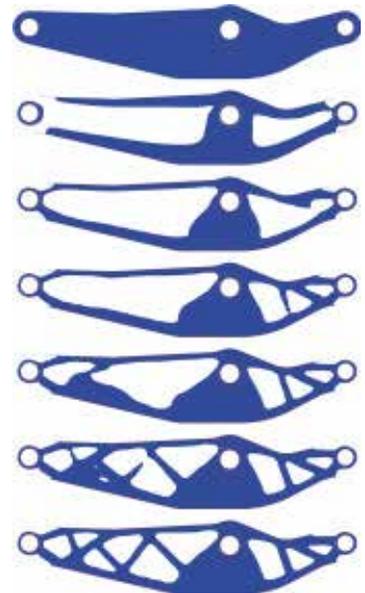
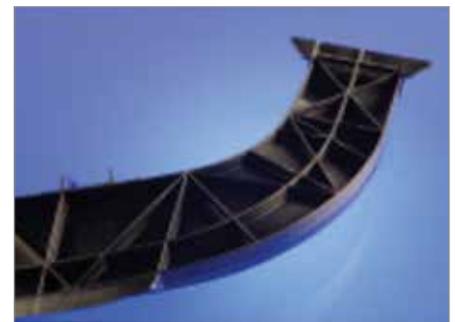Optimisation *sequence for plastic bracket in OptiStruct*

Challenge

The support of various customers in the application of modern materials demands often for new concepts that make the advantages of the material applicable.
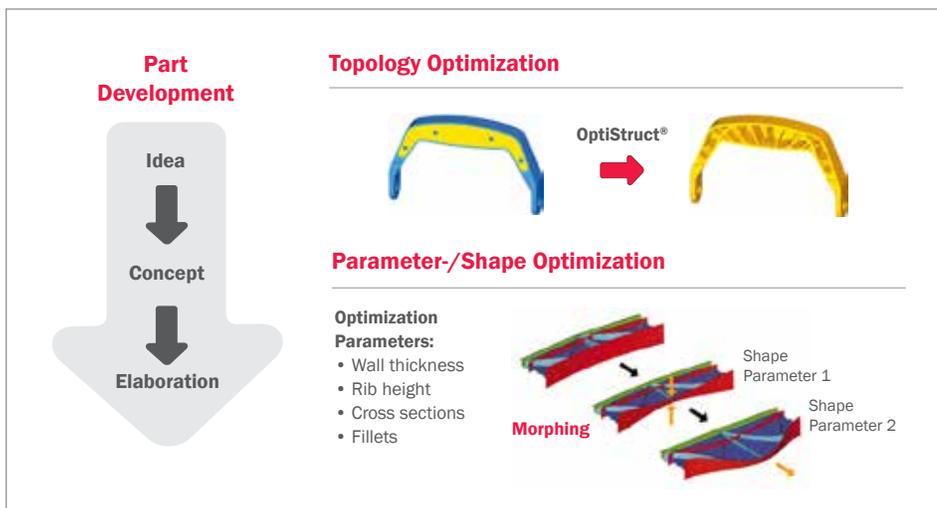
Solution

In addition to Integrative Simulation within the framework of BASF's CAE activities in recent years, Mathematical Part Optimisation has been gaining in importance. With its help not only optimum parts are designed on the computer: It also fills a gap in virtual part development. Altair OptiStruct is the initial tool in this Process.
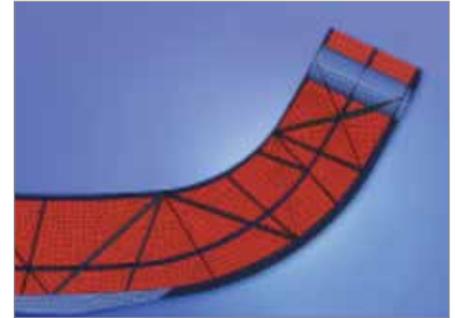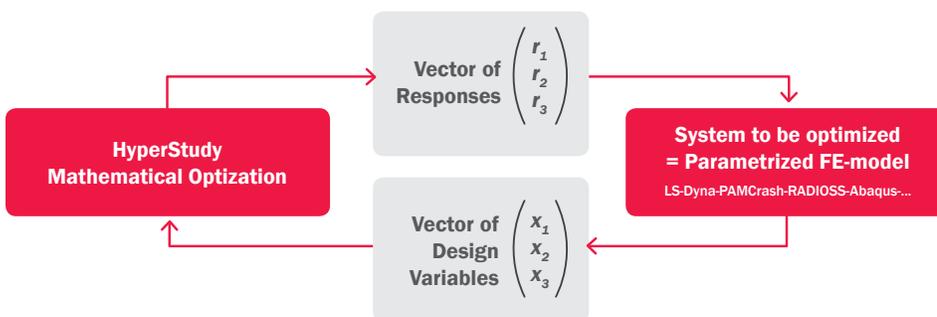

A prominent example for the outlined method is the LBS (lower bumper stiffener) for protecting pedestrians presented jointly with Opel in March 2006.

Part Development

Idea

Concept

Elaboration

Topology Optimization

OptiStruct®

Parameter-/Shape Optimization

Optimization Parameters:
• Wall thickness
• Rib height
• Cross sections
• Fillets

Morphing

Shape Parameter 1

Shape Parameter 2

Optimization in the Development Process at BASF Engineering Plastics

The prototype (top: FE model; bottom: real part) produced on the basis of the results of an OptiStruct topology optimization fulfills very well the requirements imposed in the field of pedestrian protection.

Vector of Responses $\begin{pmatrix} r_1 \\ r_2 \\ r_3 \end{pmatrix}$

HyperStudy Mathematical Optization

System to be optimized = Parametrized FE-model
LS-Dyna-PAMCrash-RADIOSS-Abaqus-...

Vector of Design Variables $\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}$

Parameter Optimization

"...no one should do without topology optimisation which fulfils its greatest potential when it is employed from the beginning of a development project If the part has the wrong shape, even the best material is useless."

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