Call for Papers, WCSMO-10

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Ludwigshafen, Jan. 1, 2013

Paper for Conference Topic 8: Applications in industry

Title:

Integrative Optimization of injection molded plastic parts – Multidisciplinary Shape and Parameter Optimization including process induced properties

Abstract:

In the field of short fibre reinforced thermoplastic parts which are manufactured by injection molding it is essential to take into account the process induced anisotropy due to the fibers to correctly describe mechanical behaviour. Many publications in recent years underline this statement.

If this class of mechanical structures is subjected to a mathematical optimization it is necessary to also include the injection molding process into the optimization process chain. This means that the type of design variables have to be extended from standard (e.g. wall thickness) to process related (e.g. injection point). Applying shape changes on the part (Morphing) will also influence both mechanical behaviour as well as the process behaviour.

In the paper a first approach is presented where all relevant types of design variables can be used and included in a multidisciplinary optimization (Integrative Optimization). The term *integrative* in this context outlines the integration of preceding manufacturing simulations in the overall modelling approach.

An introductory part of the paper focuses on the discussion of necessary changes for the general workflow of a standard optimization process. As there is a hierarchy in the simulations (first manufacturing - then mechanical simulations) the workflow as well has to be able to merge and branch in different stages.

Applying Morphing techniques (parametrized shape optimization) and including different solvers on different platforms afford further adaptations to standard parameter optimization procedures.

In a further part of the paper the coupling of MOLDFLOW®, ABAQUS®, LS-Dyna® with LS-OPT® and ANSA® (as a pre and postprocessor) is shown at a virtual test-part and at first industrial examples. The proposed new optimization workflow is proved to be useful.

The integrative character in the example is given through the (short-) glass fibre orientation in the injection molded plastic part, which has to be solved for by a preceding CFD (Flow) simulation. This leads to a strong anisotropy which will affect mechanical behaviour to a large extent. With the new approach the design variables in the optimization workflow affect both flow and mechanical simulations.