Invitation to the 72. AMAP Colloquium

Presentation by

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An Automatic CAE Tool for Autonomous Feasibility Assessment of Aluminium Gravity Die Castings

on Thursday, ***November 10th, 2022 at 4.00 pm***
with subsequent discussion at AMAP

All interested persons are sincerely invited to the AMAP foyer.
Snacks and refreshments will be available.

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Abstract

In-service performance of cast parts (strength, crash, durability) not only depends on part design but also on manufacturing effects like gating and feeders, cast part orientation in the mold, and process parameters. In the conventional, computer-aided engineering (CAE) approach, casting experts manually set up and evaluate the feasibility of an actual design variant based on the engineering specification and quality requirements of the customer. Consequently, the number of design iterations is limited.

In next-generation development processes, fully automated CAE tools and expert systems are required to provide a feasibility and quality evaluation for multidisciplinary design optimization (MDO) tools as well as design engineers in early design phases. This presentation describes the development of such a fully integrated, highly efficient and predictive Automatic CAE tool. It defines gating and feeder design and initial process conditions, runs simplified casting simulations, and quantitatively evaluates the cast part based on customer specifications.

This new approach does not require any manual user intervention by a casting expert. Additionally, by an innovative analytical method, a significant 90% calculation time reduction is achieved. Furthermore, a systematic calibration method is developed to calibrate and validate the Automatic CAE Tool. Two sets of experimental castings with different complexity are pursued. A CAE study demonstrates the plausibility and sensitivity of the estimated results.

In summary, the Automatic CAE Tool has proven to be capable of providing a fast and efficient casting feasibility evaluation in the development of high-quality lightweight cast part designs. It therefore represents an important building block for fully analysis-based design optimization methods that incorporate automatic setup and decision-making and deliver quantitative results, provided a specific calibration and validation database is developed.