METAL CASTING

Project Fact Sheet

VISUALIZATION TOOLS FOR DIE CASTING

BENEFITS

This tool will greatly increase the ability of die casters and designers to communicate with one another and to quickly evaluate a large number of design alternatives. CastView will lead to better designs, resulting in less scrap, fewer operational problems and a reduction in associated energy consumption.

The model is created with practically no effort on the part of the user. The part geometry is imported and the voxel model is automatically generated. No physical data is required.

APPLICATIONS

CastView can be applied in the die casting design phase and can be used by both designers and die casters.

CastView uses a 3-D voxel model to perform its analysis and currently runs on UNIX workstations. Work is underway to make the code available for personal computers.

The project is being monitored by the North American Die Casting Association Computer Modeling Task Force.

SIMPLIFIED VISUALIZATION TOOLS DEVELOPED TO DETECT POTENTIAL DESIGN PROBLEMS IN DIE CASTING

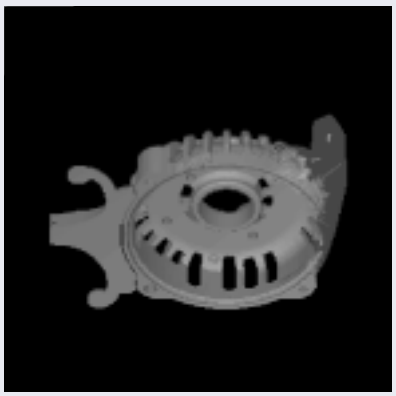
This research is helping the die casting industry to identify and resolve die casting design problems while still in the design stage. A simple qualitative method is being developed to visualize potential design problems in die casting. The software, CastView, is intended to help minimize flow-related filling problems, thermal problems in the die casting die, and solidification-related defects in the cast part.

CastView and its intended uses are quite different from typical simulation programs. It is designed to complement numerical simulation by quickly providing the part design team with a limited amount of data relevant to thermal and flow problems in die castings. The analysis is qualitative and provides information based only on the part geometry. Material properties are not required and process details are not required. This enables analysis times of only a few minutes and requires no special expertise to obtain results.

CastView addresses thermal issues by allowing the user to locate and display thick and thin sections in the part and thin sections in the die. Thick sections in the part will typically correlate well with the last sections to solidify and with shrinkage porosity. Thin sections in the part may present premature solidification problems or fill problems. *Detecting these problems early in the process enables the die caster to negotiate a modification of the part geometry with the part designer to achieve a more castable part.*

QUALITATIVE PREDICTION OF FILL PATTERN

THIS IMAGE SHOWS A QUALITATIVE PREDICTION OF THE FILL PATTERN DURING THE LATE STAGES OF FILL. IN THIS CASE, THE TOWER REGION ON THE RIGHT SIDE IS LATE TO FILL AND IS A VERY THICK SECTION. EVEN WITH NO CHANGES IN THE PART GEOMETRY, THE POTENTIAL FOR DEFECTS WOULD BE GREATLY REDUCED BY ROTATING THE PART 180 DEGREES IN THE DIE, PUTTING THE TOWER NEAR THE GATE. CASTVIEW MAKES IT POSSIBLE TO SEE THIS WITH ONLY A FEW MINUTES OF ANALYSIS.



The CastView 3-D voxel model enables rapid calculation of approximate distances which form the basis for all results. Image courtesy of Ohio State University.

Project Description

Goal: *To develop and test die casting design evaluation techniques based on the visualization of geometric data that is related to potential defects of problems.* Specifically, thickness information is used to provide insight into potential thermal problems in the part and die. Distance from the gate and a special type of animation of the fill pattern is used to provide an assessment of gate, vent and overflow locations.

A second phase of this research is further promoting compatibility between die casting part and die design. Specific goals are to reduce part development lead time by at least 15% and reduce tryout and setup time by at least 30%.

Progress and Milestones

- Methods were implemented for rapid evaluation of potential thermally related defects and results were compared with field reports and numerical simulations.
- Simple methods were found to be effective in locating heavy regions and thin regions which correlate well with shrinkage regions and hot spots.
- Qualitative methods for flow related defect analysis have been developed which provide results in just minutes.
- Design tests were performed.
- Interim results published in the May/June 1997 issue of *Die Casting Engineer.*
- Numerous demonstrations have been made at industry conferences and expositions.
- The second phase will extend the fill analysis to include lower velocity flow present in low pressure die casting, squeeze casting and gravity casting,
- Thermal/temperature extensions will be performed in the second phase to provide a relative, equilibrium temperature distribution in the part and die.
- Qualitative shrinkage/distortion predictions for the part also will be performed in the second stage.
- Technology transfer is being coordinated through the Cast Metals Coalition and the North American Die Casting Association.

Project Partners

EXCO Engineering, New Market, Ontario

Ford Motor Company, Dearborn, MI

General Motors Powertrain, Pontiac, MI

ITT Industries, Auburn Hills, MI

J.L. French Corporation, Sheboygan, WI

North American Die Casting Association
Rosemont, IL

Ohio State University, Columbus, OH

Ryobi Die Casting, Inc., Shelbyville, IN

Spartan Light Metal Products, Sparta, IL

Tool Products, Minneapolis, MN

Walkington Engineering, Cottage Grove, WI

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