Example: One

Date: March, 2010

Gating system is an important factor in the production of quality castings, therefore, should be fully considered in the design and construction of pattern. This tutorial will explain how to do specific steps for simulation to design the casting parts with highly accuracy without spending too much time in production line.

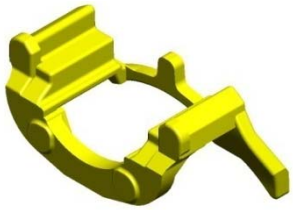
Part name: Bracket Process: Disamatic vertical molding The number of cavity per mold: 6 Task: Gating system modification Material : GGG50	

Fig.1

First step: Solidification Simulation

Note: Solidification simulations help us to identify and Proper design of the risers (number, location, and size)

For every pair of parts 3 risers with 5 cm in diameter by 7.7 cm in height were applied.
With solidification simulation any defects related to solidification in cast part can be detected.
In fig 2, 3 the simulation results show the shrinkage and Liquid mapping of the process.

Fig.2 Liquid mapping

Fig.3 shrinkage is only in risers and cast parts free of shrinkage

There is no shrinkage in cast parts, plus location and sizes of riser were selected properly. (The next step might be optimization of the process: re-design the riser using simulation). Briefly, for size and location of risers, these functions from SUTCAST solidification simulation should be considered:

- Module
- Liquid mapping
- Shrinkage
- Thermal distribution

For more explanations, we recommended you to visit our *solution* pages in our website.

Second step: Mold filling Simulation (checking the gating system dimensions)

Proper design of an optimized gating system will be made easier by application of fluid flow simulation. For the reminding, to design the gating system we should consider the following factors as priority:

- Minimizing Turbulence
- Rapid mold filling
- Maximizing Yield
- Removal slag, Dross, and inclusions
- facilitate gating removal
- Desire thermal gradients

It is important to fill every mold quickly, but turbulent flow needs to be avoided. Fig.4 shows the initial structure of gating system for this part.

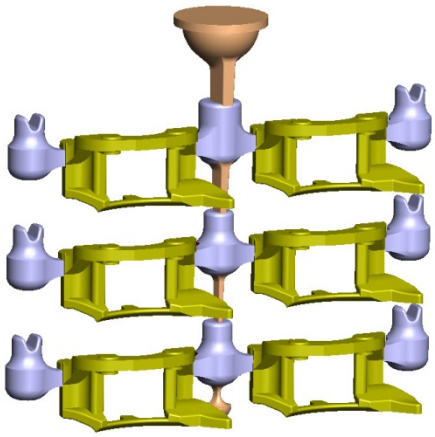


Fig.4 gating system

To speed up the calculation of gating systems and Design the appropriate choke,

Equation (1) can be used.

F (choke area) $= \frac{1036xG}{\mathrm{t.m}\sqrt{h}}$

G= weight of molten metal

t= 8 s (filling time)

h = height (h1, h2, h3)

m = 0.5 (coefficient of friction)

By mold filling simulations the results at 3s and 5.5s time of filling (Fig 5 and 6), confirm that this gating approach is not appropriated, because Some cavities are going to fill (vertical parted molds as a guide) in less than 8 s (Bottom) and some after 8s (Top).

All of cavities should be filled by molten metal at the same time.

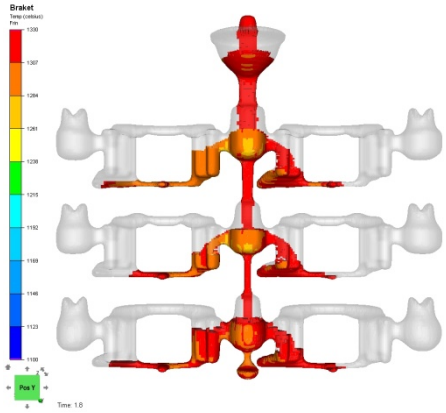


Fig 5

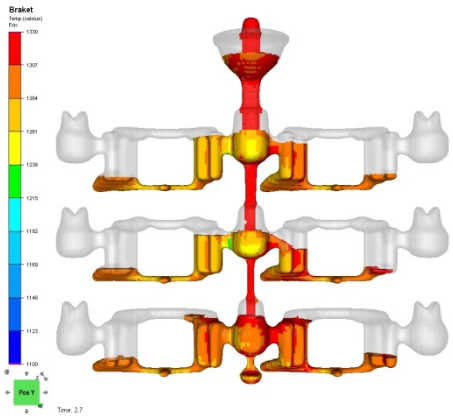


Fig 6

To re-sizing chocks area and set up the filling time in upper and middle and lower cavities, we can Re -calculate the F1, F2, F3 based on 8s seconds. It is important to know that the real coefficient of friction (m) can be determined only after mold filling simulation. Once applied changing, we run the mold filling simulation again to see how all of cavities are filling by molten metal.

Fig 7 and Fig 8 show after 3s and 5.5s these confirmed all cavities are filled at the same time.

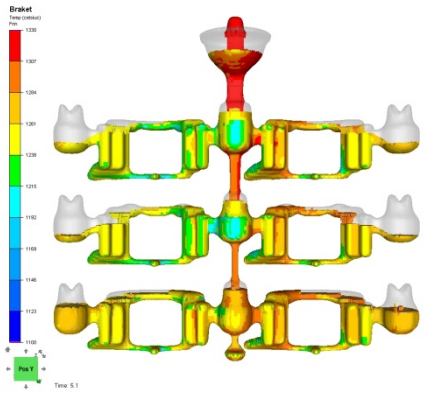


Fig 7

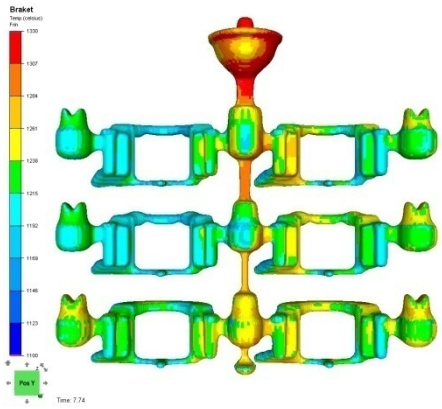


Fig 8

With application of simulation, we can optimize our design in the short period of time and decreasing cost. Imagine how much cost is going to be if you rely on try and error method in your production line.

Lessons learned:

The outputs from these simulations are:

- The Mold filling and solidification of the designs were simulated using SUTCAST
- Proper design (location, number, and size) of the risers can be determined from solidification simulation
- A predicted map of possible macro-shrinkage defects
- The appropriate of choke and gating system can be determined quickly through fluid flow simulation.

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