

## AROUND-CASTING SIMULATION WITH OPENFOAM®: VERIFICATION AND APPLICATION OF MODELS

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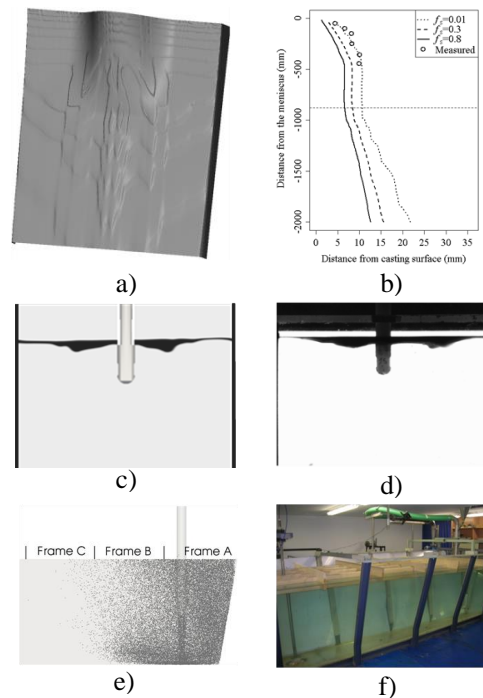
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New casting technologies promote energy savings along with the higher production rates [1,2]. However, problems like sensitivity to breakouts and edge/surface cracking arise, encouraging metallurgists to consider new approaches and, for instance, special mold design. Numerical modeling became an efficient analysis tool to assist the industry. It is applied for the defects prediction along with the surface quality estimation.

Solidification model, developed by the authors [3-6], includes simulation of the turbulent flow of the liquid melt taking into account interaction with the two phase region during the formation of the solid shell (Fig. 1a). For the prediction of the solid motion during its continuous withdrawal a deformation model is applied [7]. The VOF approach is utilized to model free surface behavior in a 3 phase liquid steel/slag/air system (Fig. 1c). Non-metallic inclusions, another source of the defect nucleation, are treated as Lagrangian particles (Fig. 1e) within the frames of the DPM theory. Full coupling between turbulent flow and discrete phase is implemented.



**Figure 1: Simulation and experimental results: (a) simulated and (b) measured shell thickness; (c) 3-phase VOF; (d) water/oil/air experiment; (e) DPM simulation and (f) water model setup**

Verification of the multiphase solvers, developed in the OpenFOAM® environment, is performed based on the breakout measurements of the shell thickness (Fig. 1b, [8]) as well as on the different free surface (Fig. 1d) and particle flow water experiments (Fig. 1f). Simulation results show good agreement with the experimental data, approving their direct application for the industrial processes.

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