Numerical Analysis of the Flow Structure in the Continuous Casting Two-strand Tundish

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Introduction: In presented paper calculations were carried out for the water model of the investigated tundish (60Mg), represented on a scale 1:3. Numerical calculations enable to estimate the fluid flow velocities, pahtlines and other parameters. Calculations were done for two different grids. Based on the results, the flow structure in the investigated tundish was obtained.

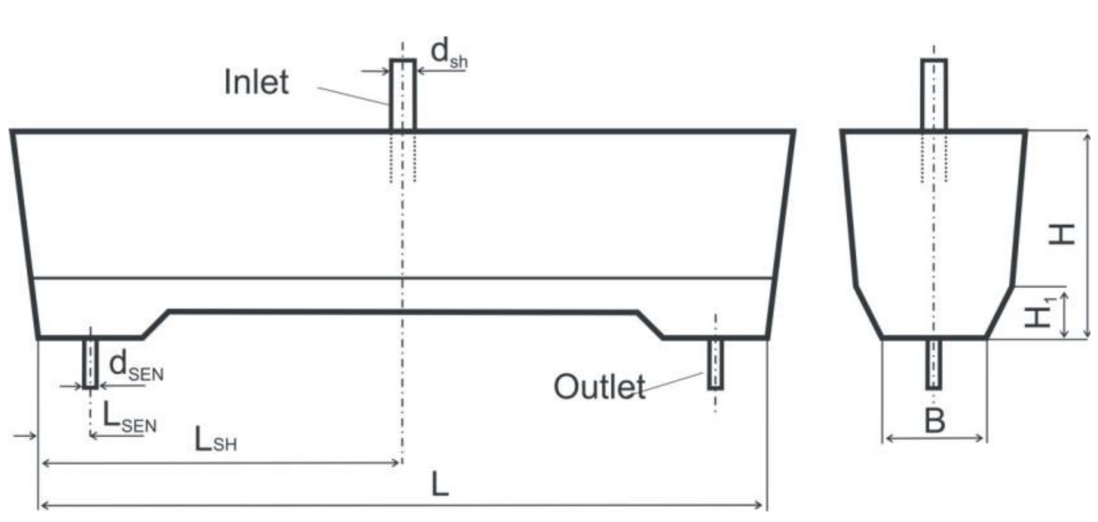

Figure 1. Scheme of the tundish shape and its size

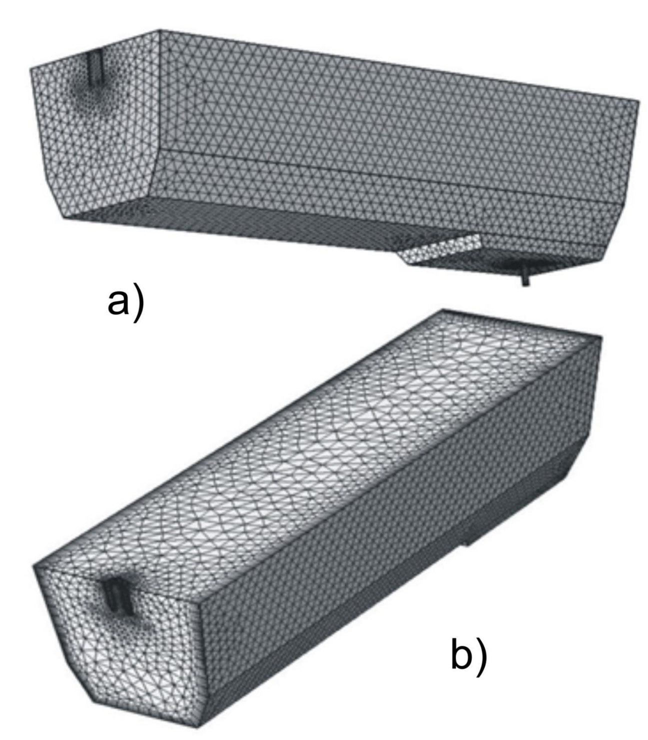

Figure 2. Computational mesh set at walls of the tundish: a) basic grid, b) finer grid

Computational Methods: Half of the tundish was chosen for the mathematical analysis. In current study the influence of density of numerical grid on the results has been tested. Considered model contains 53 000 and 160 000 cells. Basic grid was improved by making a finer mesh in the zone of the incoming and outgoing liquid jet in order to visualize in more details the effects of velocity and turbulence gradients.

The walls are considered with no slip condition for the fluid flow. The upper surface is assumed as a free surface with zero shear stresses. The standard wall function is used to calculate the value of a node near a solid wall.

For modeling the turbulence k-ε model was set to calculate flow of incompressible medium (water) at the ambient temperature.

Calculations of the velocity field and pressure were conducted in the transient state „Time Dependent Procedure" till reaching the process time t=360 s.

Results: To facilitate comparison of results, the object was sectioned by characteristic planes.

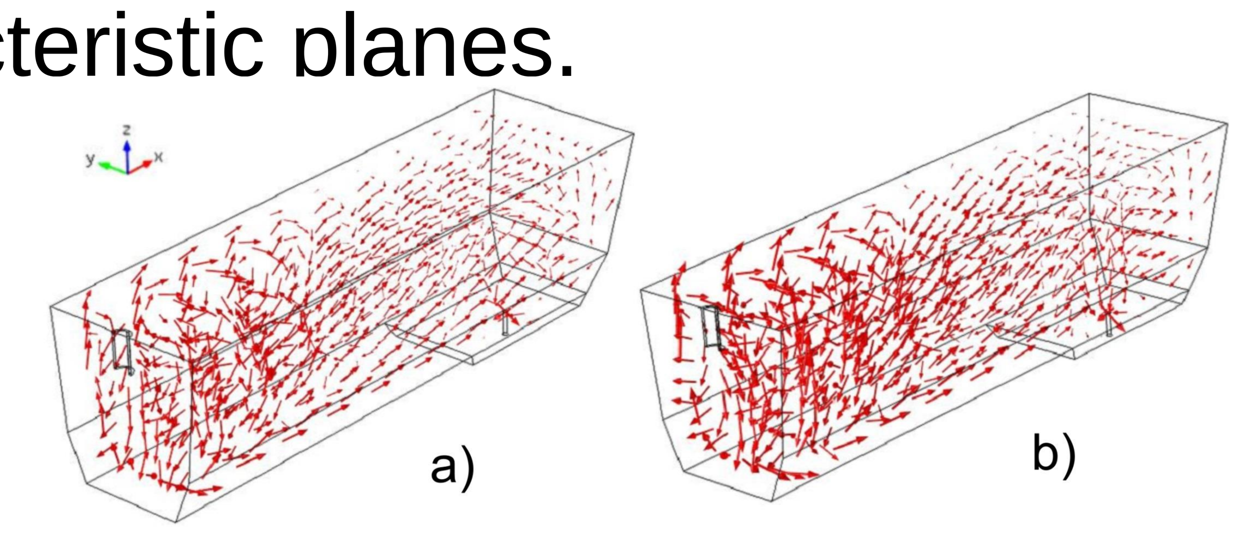

Figure 3. Velocity vectors of the fluid in the tundish: a) basic grid, b) finer grid

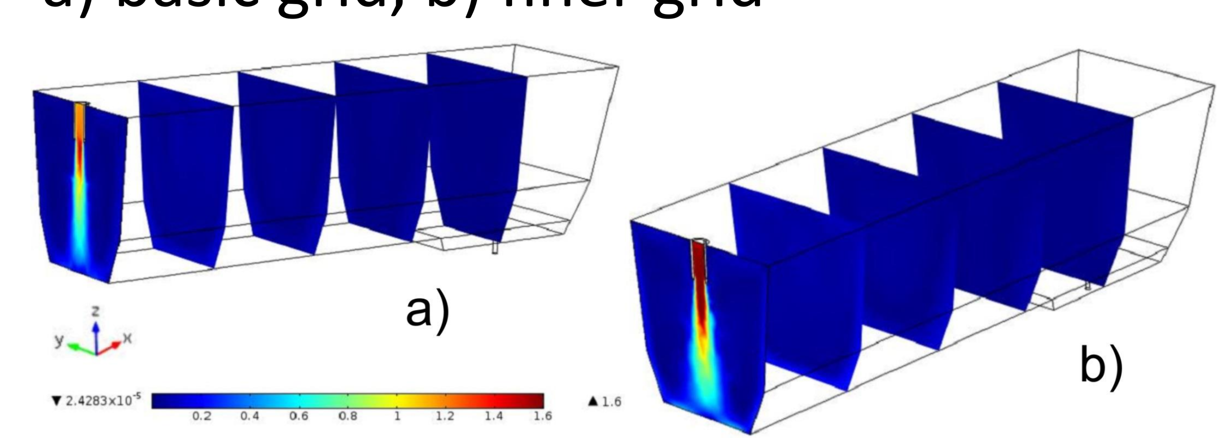

Figure 4. Velocity fields in the tundish: a) basic grid, b) finer grid

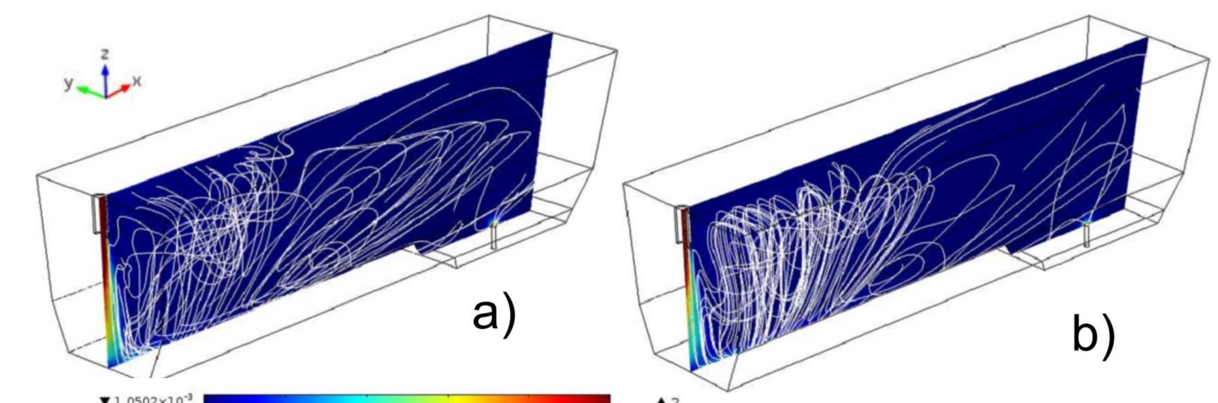

Figure 5. Velocity fields and streamline in the tundish: a) basic grid, b) finer grid

Conclusions: Analysis of the velocity field distributions of the liquid inside the tundish are an important source of knowledge about the conditions of steel casting. However, these characteristics do not involve outright which computational grid is optimal. To evaluate the selection of an optimum computational grid one should conduct a more detailed numerical analysis and verify the results with experimental measurements of the water model.

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