

Some approaches for numerical modeling of electrovortex flows in a finite volume

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Abstract: Electro Vortex flow is very important in various applications such as electrical metallurgical furnace, electrical welding, cristal growth, etc. This work presented investigation of electrovortex flows of a liquid metal in a finite volume for various electromagnetic and hydrodynamic regimes. The melt motion was described by magnetic hydrodynamic equations for an incompressible isothermal and non-isothermal fluid. A strategy for solving the problem with the use of standard packages of applied programs has been developed.

The laminar flow of the melt at small Reynolds numbers, for which there is a known solution, as well as the turbulent flow, for which there are experimental data, have been calculated. In calculating the turbulent flow, various turbulence models were used. It has been shown that the k - ϵ , k - ω and LES models describe satisfactorily the electrovortex flow of the liquid metal and agree well with experimental data. The good agreement between the results of calculations made with the use of various methods and software packages, as well as between theoretical and experimental data, provide the reliability of the developed methods and approaches and the validity of the obtained results.

Keywords: Lorentz force, turbulent electrovortex flow, numerical simulation

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