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Effect of a Magnetic Field on Turbulent Flow in Continuous Casting Mold[1] RAMNIK SINGH, PRATAP VANKA, BRIAN G. THOMAS, University of Illinois — Electromagnetic Braking (EMBr) fields are applied to control the turbulent mold flow for defect reduction in continuous steel casting. The effect of EMBr depends on the path of induced electric current which is modified by presence of the highly conducting solidifying shell. The mold geometry is complex involving flow in a high-aspect ratio closed channel with bifurcated jet impinging obliquely on the side walls. The extremely transient nature and the anisotropic behavior of turbulence under the EMBr field make numerical studies challenging. We use large eddy simulations to study effects of EMBr with electrically insulating and conducting boundary conditions. Magnetohydrodynamic equations are solved using a fractional step method with second order spatial and temporal accuracy. The electric potential method is used as magnetic Reynolds number is low for liquid metal flows. The solver was first validated with measurements from scaled GaInSn model and simulations were then performed to study real casters at industrial conditions. Time averaged and transient behaviors of the flow were studied by collecting distributions of mean velocities, turbulent fluctuations and vorticity. The simulations reveal that the electrical boundary conditions have a major effect on the flow structure.

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