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Investigation on Mesh Sensitivity of a Transient Model for Nozzle Clogging

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Abstract : A transient model for nozzle clogging has been developed and successfully validated against a laboratory experiment. Key steps of clogging are considered: transport of particles by turbulent flow towards the nozzle wall; interactions between fluid flow and nozzle wall, and the adhesion of the particle on the wall; the growth of the clog layer and its interaction with the flow. The current paper is to investigate the mesh (size and type) sensitivity of the model in both two and three dimensions. It is found that the algorithm for clog growth alone excluding the flow effect is insensitive to the mesh type and size, but the calculation including flow becomes sensitive to the mesh quality. The use of 2D meshes leads to overestimation of the clog growth because the 3D nature of flow in the boundary layer cannot be properly solved by 2D calculation. 3D simulation with tetrahedron mesh can also lead to an error estimation of the clog growth. A mesh-independent result can be achieved with hexahedral mesh, or at least with triangular prism (inflation layer) for near-wall regions.

Keywords : clogging, continuous casting, inclusion, simulation, submerged entry nozzle
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