Computational Fluid Dynamics Modeling of Erosion of a Solid Bed by Jet Impingement

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Abstract

Computational fluid dynamics (CFD) is an emerging tool for predicting flow fields in a mixing environment. Confidence in models for solid-liquid mixing is of growing demand. Many studies have been done to look at impeller mixed systems, both in single and multi-phase systems. This work focuses on the physics of jet-induced mixing. How well can CFD predict the flow fields in single phase systems? If well enough, can we extend our confidence to solid-liquid systems?

Results of CFD models are compared to experimental data and theoretical applications from literature. First, CFD results are compared to single-phase impinging jet correlations from literature (Poreh, 1967) for wall shear and velocity decay. Next, a model of a transient, intermittent jet is compared to single-phase experimental velocity measurements made in a mixing vessel. Finally, a CFD model of a steady, clear impinging jet scouring a layer of solids is compared to data for rate of erosion and zone of influence.

keywords: Computational Fluid Dynamics, solid-liquid mixing, experimental validation