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Abstract:	Wet gas-solid fluidization is an essential component in a wide range of industrial processes, particularly those in the energy and pharmaceutical industries. In gas-solid fluidized beds, solid particles are suspended against gravity by a drag force from upward flowing gas. When liquid is added to the bed, particles become coated in a thin liquid film, which gives rise to the formation of pendular liquid bridges upon particle-particle and particle-wall collisions. These liquid bridges provide a cohesive force that results in the formation of agglomerates that influence the flow behavior within the bed. The focus of this thesis is to understand how agglomerate formation and fluidization behavior are dependent on the wetting properties. Data is collected from a wide range of Euler-Lagrange simulations that allow for dynamic liquid bridge formation and rupture. The dependence of fluidization behavior on wetting parameters is described using a key dimensionless group, referred to here as a modified Bond number. The modified Bond number, which accounts for both surface tension effects and liquid loading level, correlates strongly with average liquid bridge coordination number, demonstrating its origins relating to agglomeration strength. While the domain size used in the study is suitable for the use of microscale computational grids, a filtering methodology is proposed for use in larger coarse-grained systems in which a liquid phase is present on the particles. A filtered drag coefficient is provided as a function of filter size, solid loading, and the wetting parameters. Liquid in the fluidized bed exists both on the surface of particles, where it reacts to form higher valued products, and also within pendular liquid bridges, where it binds particles together to form agglomerates. The distribution of liquid on the particles and in the bridges is assessed as a function of the wetting properties. The study concludes with an analysis of liquid spreading in an inhomogeneously wetted bed, relating the rate of liquid dispersion to the surface tension forces present in the system. The results of the entire study allow for prediction of fluidization behavior based on the wetting parameters, allowing for simulation of large-scale systems appropriate for use in industrial application.
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