287c Dynamic Model of the Riser in Pilot-Scaled Circulating Fluidized Bed

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Circulating fluidized bed (CFB) reactors have been applied successfully to numerous processes with gas-solid reactions, such as the combustion of coal and fluid catalytic cracking. Optimization and control of CFB is very important due to the large scale of many of the processes that use it and requires an accurate, real time, dynamic model to describe and quantify the process. The present work focuses on modeling the transient behavior of pilot-scaled CFB units, whose flow characteristics were shown to yield C-shaped voidage profiles. The riser is subdivided into 2 stages with different model formulation due to its axial non-uniformities. The first stage includes the bottom zone and fully developed zone, which is modeled as an axisymmetric cluster flow. The cluster flow model assumes that gas and solids flows are unidirectional with no mixing in the axial direction, and the solids move upward in the riser as clusters instead of individual particles. The second stage is the exit region, which can be assumed that the flow of gas and solids is characterized by a high extent of mixing. A perfect-mixed-tank model is applied in the exit region of the riser. Using this method, the smooth changes in voidage profiles for transient processes are predicted successfully along the riser. This model can also be used in reaction system. Examples will be given for the combustion of coal, and the concentration profiles of gas and solids can be predicted in transient processes.