CFD STUDY OF GAS-SOLID FLOW
IN
CIRCULATING FLUIDIZED BED COMPONENTS

by

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Fluidised beds
Gas-Solid Reacts.

CERTIFICATE

This is to certify that the thesis entitled **"CFD STUDY OF GAS-SOLID FLOW IN CIRCULATING FLUIDIZED BED COMPONENTS"**, being submitted by **SANJIB KUMAR DAS SHARMA** to the Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy in Chemical Engineering, is a record of bonafide research work carried out by him. Sanjib Kumar Das Sharma has worked under my guidance and supervision and has fulfilled the requirements for the submission of the thesis.

The results contained in this thesis have not been submitted in part or in full to any other university or institute for the award of any degree or diploma.

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ABSTRACT

CFD simulations of gas-solid flow in bubbling fluidized bed and riser, which are the two main components of a circulating fluidized bed, have been carried out. The Eulerian approach is used wherein the particle phase is also taken as a continuum and its constitutive properties obtained from the granular kinetic theory. The aim of the study for both bubbling bed and the riser is the determination of the bed flow structure. Transient calculations are made but only 2-D as large computation times are involved. In all the simulations the commercial software FLUENT is used. A detailed analysis of the flow structure in a 2-D bubbling bed with horizontal tube bank is made. Results are presented in terms of average bubble diameter and bubble rise velocity and their variation with height. The predictions are validated with the experimental data of Hull et al. (1999). The comparison shows a good agreement. Subsequently, the effect of the tube-bank geometry, inlet gas velocity, particle size and density, tube diameter, horizontal and vertical tube spacing is also presented. A similar study is carried out for a 2-D riser with high solid mass loading and high inlet gas velocity. Results are presented in terms of the variation of the average solid concentration, solid volume fraction and solid flux with the width of the riser and the axial variation of average solid volume fraction. The results are compared with the experimental data of Knowlton et al. (1995) and a good agreement is obtained. Further simulations are carried out to study the effect of particle size, particle diameter, inlet solid flux and inlet gas velocity on the gas-solid flow structure and these results are also presented.

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