MODELLING OF MULTIPHASE FLOW CONTAINING BUBBLES, DROPS AND SOLID PARTICLES

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The methods of multiphase flow dynamics modelling are known. The theoretical calculation of the flow dynamic parameters of multiphase medium is based on the assumption of the mutual interaction between the phases, which becomes essentially manifested if mass concentration of the dispersed phase exceeds the value of 20 %. In many cases this limit seems to be even too high. The results of the experimental investigation of moderate and dense suspension flow confirm that the influence of solid particles on the suspension flow behaviour and the rheological parameters can be significant even for the mass concentration less than 20 %. In this paper the model of multiphase flow, which is based on the joint solution of vector equations of dispersed particle motion in Lagrange coordinates and the equation of continuum in Euilerian coordinates, is presented. The method is applied to axially symmetrical flow of incompressible fluid in the rectangular channel and to flow in the zigzag channel. In the case of zigzag channel the numerical scheme is proposed.

Key words: *multiphase flow, concentration of the dispersed phase, particle motion, rectangular channel, zigzag channel*

1. Introduction

Flow behaviour of the moderate and dense slurries is strongly affected by mutual particle-particle and particle-liquid interaction. The presence of the fine solid particles in a Newtonian liquid evokes a complex rheological behaviour of the suspension. During the flow shear-induced translation and rotational motions of the particles cause hydrodynamic interactions, which lead to the increase of viscous energy dissipation and the suspension bulk viscosity. Inter-particle interactions of non-hydrodynamic origin are most significant in the colloidal systems. In the highly concentrated fine-grained suspensions both types of the interactions exist. The flow pattern depends strongly on the dense phase concentration. If the dense phase content increases, the flow behaviour changes from Newtonian to non-Newtonian, which can be generally described by the yield pseudo-plastic model.

After mixing of the solid particles and liquid, attractive and repulsive forces between the particles initiate process of coagulation and peptisation, respectively. A mutual effect of the attractive and the repulsive forces between the solid particles determines the behaviour of the system. Balance or dominance of repulsive or attractive forces between particles could explain a mechanism of suspension liquefying or thickening.

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