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NUMERICAL MODELING OF MULTIPHASE STOKES FLOWS IN MICROGRAVITY CONDITIONS

Abstract

A lot of technological processes in usual terrestrial conditions are based on multiphase flows. It is evident that development of space technologies leads to using of multiphase flows, but in microgravity conditions. In contrast to terrestrial gravity conditions, quite slow fluid flows and second phase object motions are specific for microgravity conditions, because main factors, which stimulate free convection under standard gravitation, are enough small in microgravity. More than that, a forced convection often is absent in general there due to technological reasons. Thus it is quite natural to assume that multiphase flows in microgravity have Stokes mode. Let us consider the cautions of second phase motions in microgravity. Beside of usual weak body forces which lead to slow flotation or sedimentation in dependence on relations of densities, a lot of effects can have comparable actions, for example, thermophares, diffusiophares, Marangoni effect (the last one takes place in case gas-liquid boundary). Other actions are connected with motion of main phase fluid caused by weak free convection, hydrodynamic effect of phase transitions and chemical reactions, motions of second phase objects (hydrodynamic interaction of them) and other phenomena. Influences of correspondent separate effects strongly depend on particular conditions of the process and, thus, the mathematical models of the process cannot be simplified in general case. However, mathematical and numerical modeling of the considered phenomena, in general case is rather useful less due to a lot of completely different effects and large number of parameters. Then the mentioned effects must be analyzed separately with following using of correspondent result in general analysis. However even consideration of any separate effect requires development of specific mathematical models and numerical algorithms. Boundary element method together with asymptotic analysis is used in the present work for development of mentioned mathematical and numerical models. Several examples of numerical calculations are made to illustrate the considered problems.