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Formation of Fine Structures in Uniform Suspension under Standing Waves Action

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Structurization of initially uniform suspension in fields of standing gravity waves was studied in a rectangular tank oscillating in vertical direction. The tank with aspect ratio of 50:4 was placed at shaker table with a low level of horizontal components of acceleration during the motion. Diluted aluminum powder suspension in water filled in tank with was undergone wave action in frequency range corresponding to first and second modes of intrinsic oscillations. For visualizations and tracers velocity measurements a digital high-speed video camera was used. The formation of large and small scale structures in initially uniform suspension was registered. Experiments were performed in tanks with flat smooth and rough bottom as well as with water above stationary ripples and deformable sand riffles. Large and small scales irregularities of initially smooth field of concentration were observed in the whole volume of the fluid. Large voids with shapes reminding the bottom topography features were formed first. Later the fine extended filaments were observed. Their horizontal scales were determined by bed forms extension, and the vertical scale grows in time. Depending on the wave mode the filament structures arose from the bottom or sank from the free surface. The evolution of the structure geometrical parameters were measured both in vertical and horizontal directions. The difference of dynamical behaviour of suspension concentration in vicinity and far from free surface, flat bottom or bed topography was determined and discussed. In theoretical description of the flow compete fundamental set of governing equations. Complete solution of the set contains family of thin singular perturbed components which are characterized by singular perturbed functions. These flow components can accumulate of admixtures and maintain non-uniform pattern of admixture concentration. The presented experiments were performed on set-up USU "HPC IPMec RAS" under support of Ministry of Education and Science RF (Goscontract No. 16.518.11.7059).