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LIFT FORCE ACTING ON SOLID IN LIQUID NEAR THE BOUNDARY PERFORMING TANGENTIAL OSCILLATIONS

Abstract

The oscillations of body in liquid could lead to generation of averaged lift force [1,2]. It could be excited by oscillating force field (inertial for instance) if body density is different from the liquid one. The important problem is the dynamics of the body in immovable liquid near the oscillating boundary, when the body density does not play role, and may coincide with the density of the liquid. The dynamics of bodies with density slightly different from the fluid in the coaxial gap filled with fluid and subject to do high-frequency rotational oscillations is experimentally investigated. Along with the annulus the simply connected cavity (the annulus with a longitudinal partition) is considered. The experimental technique corresponds to [1]. The frequency and amplitude of vibration vary in the experiments. The body oscillations and its mean interaction with the boundary was studied using the high-speed videoregistration. It was found that the repulsive force acts on the body near the oscillating boundary. With increasing the vibration intensity the threshold repulsion of solid from the boundary and their transition to the suspended state (in gravity field) take place. The lift force as function of vibration parameters and fluid properties, and the dependence of the dimensionless lift force on the distance to the boundary were studied. It is shown that the lift force acts at a distance of viscous interaction and decreases rapidly with the distance. In a simply connected cavity an important role in the generation of the averaged lift force play the fluid shear oscillations associated with the nontranslational cavity vibration. It is shown that the loss of stability of the symmetry of solid oscillations relative to the boundary results in excitation of the tangential component of the vibrational lift force.

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References

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