# On Interaction Between Three-dimensional and Two-dimensional Waves on Falling Liquid Films

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### ABSTRACT

In the present work the results of experimental study of major regularities of interaction between solitary three-dimensional (3D) waves and regular two-dimensional (2D) waves on the surface of vertically falling liquid film are presented for $5<Re<25$ for liquids with different physical properties. To study spatial structure of interaction between waves with high spatial and temporal resolution the Laser-Induced Fluorescence technique [1] was modified. 2D waves were excited by external controlled periodic perturbation of the liquid flow rate. 3D waves were excited by the impact on the surface of the liquid film by a working liquid drop [1, 2].

Two universal scenarios of interaction have been observed. The first scenario is decaying of 3D waves in the process of propagation under interaction with low-frequency 2D waves belonging to the $\gamma_2$ family. The second scenario is realized when of 3D waves are interacting with high-frequency 2D waves belonging to the $\gamma_1$ family. In the latter case the shape of 3D waves are similar to the shape of 3D waves on a smooth film but weakly oscillates in the process of interaction.

In the second scenario of interaction the regimes in which all characteristics of 3D waves are identical in the same phases of consecutive acts of interaction with 2D waves have been detected. Such regimes of interaction were considered as stationary. Experimentally registered amplitudes of 2D and 3D waves in stationary regimes of interaction are generalized well in dimensionless coordinates proposed in [3, 4]. Analysis of experimental data reveals differences between the amplitudes of stationary 3D waves traveling on a smooth film [2] and the amplitudes of 3D waves in stationary regimes of interaction.

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