EVOLUTIONARY CHARACTERISTICS OF RIPPLES GENERATED BY DISTURBANCE WAVES IN ANNULAR FLOW

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ABSTRACT: Entrainment of liquid from liquid film surface in annular gas-liquid flow exerts essential influence on the integral characteristics of flow. Entrainment occurs due to interaction of large-scale disturbance waves and small-scale ripples [1]. Recently, experimental system for field measurements of liquid film thickness was developed based on laser-induced fluorescence technique [2]. Analysis of both spatial and temporal evolution of film surface showed that the ripples are generated at the back slopes of the disturbance waves. Subsequently, the ripples can either travel over the base film between the disturbance waves (‘slow ripples’), or travel over disturbance waves (‘fast ripples’). Disappearance of the fast ripples was related to the scattering of the fast ripples by the gas shear into droplets.

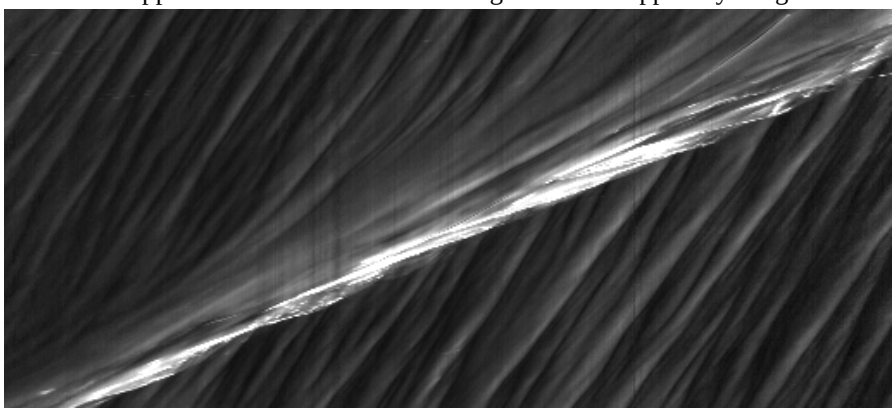

Fig. 1 Fragment of x-t-surface of film thickness. Horizontal axis corresponds to longitudinal coordinate (total length is 100 mm); vertical axis corresponds to time (total length 50 ms). Brightness is directly proportional to local film thickness. Disturbance wave, covered by the fast ripples (short bright bands), moves along the diagonal. The base film is covered by the slow ripples.

In present work, the new algorithm of data processing is developed, aimed for separate studying of the disturbance waves, slow ripples on the base film between disturbance waves, and fast ripples on disturbance waves. Both separation and processing parts of the algorithm involve cross-correlation analysis, spectral analysis and statistical treatment of film thickness records. Peculiarities of spatial and temporal behavior of waves of different types are taken into account. For slow ripples, evolution of properties with distance from parent disturbance wave is investigated.

References

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