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Hydrodynamics of the Solitary Waves Travelling Down a Liquid Film

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The regular solitary waves on the surface of a liquid film flowing down an inclined stationary plate were excited by means of the flow rate pulsations. The direction sensitive, two-segment electrodiffusion probe was flush mounted into the wall to measure the fluctuating wall shear rate. The results of electrodiffusion measurements provided some basic characteristics of the wavy flow regime and confirmed the existence of a small backflow region located just in front of the solitary wave. To confirm independently this finding, the high-speed camera together with microscopic objectives was installed to carry out the particle tracking velocimetry inside the flowing liquid film. The visualization of small particles motion in the near-wall region revealed that the capillary waves provoke strong pulsations of the near-wall flow velocity. These successively growing flow pulsations finally result in the short-time flow reversal, which has the duration of a few milliseconds.

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