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An Experimental Investigation of the Free Surface Profiles Generated by a Moving Pressure Source: Solitary Capillary-Gravity Waves[1]
J.D. DIORIO, N. WATKINS, J. ZUECH, J.H. DUNCAN, Department of Mechanical Engineering, University of Maryland — There have been several recent numerical investigations that have shown the existence of three-dimensional nonlinear solitary surface wave patterns that propagate with speeds less than the minimum wave phase speed prescribed by linear theory (23 cm/s for clean water). In the present study, wave patterns were generated by translating a small-diameter region of high pressure across a water surface. The high-pressure region was created by forcing air through a small-diameter vertically oriented tube attached to a carriage that propelled it horizontally at speeds near 23 cm/s. The wave pattern was measured with a cinematic LIF technique. It was found that a steady solitary wave pattern can exist at speeds below the linear-theory minimum phase speed, while for speeds above the minimum, a pattern of gravity-capillary waves was produced. The solitary wave pattern, which only appeared when the pressure forcing was large, dissipated rapidly when the forcing was turned off. The streamwise dimension of the solitary wave was much smaller than the transverse dimension.

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