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The Cross-Stream Structure of the Crests of Breaking Waves[1]
J.H. DUNCAN, J.D. DIORIO, X. LIU, Department of Mechanical Engineering, University of Maryland — Surface profiles and flow fields in the crests of breaking waves are usually measured in vertical stream-wise planes. However, measurements of the turbulent flow in boundary layers along flat rigid walls have indicated the importance of streamwise flow structures. In the present study, breaking waves are examined in a tank that is 12.8 m long and 1.2 m wide with a water depth of 0.91 m. A programmable wave maker is used to generate wave packets (central frequencies 1.15 - 1.42 Hz) that create breakers by dispersive focusing. Different amplitudes of the wave maker motion are used to generate various breaking waves ranging from weakly spilling to plunging breakers. A cinematic 2D LIF technique is used to measure the crest profile histories and the light-sheet plane is oriented to measure both the stream-wise and cross-stream crest profiles in separate experiments. It is found that the development of ripples due to turbulence-free surface interactions is highly repeatable and that even though the waves are two-dimensional before breaking, the amplitude of the cross-stream components quickly reaches 50% of the stream-wise ripple amplitude.

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