## Abstract View

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# On the Structure of the Velocity Field over Progressive Mechanically-Generated Water Waves

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ABSTRACT

The structure of the velocity field over a propagating wave of fixed frequency is examined. The vertical and horizontal velocities were measured in a transformed Eulerian wave-following frame of reference in a wind-wave research facility at Stanford University. Experimental results are given for seven different wind speeds in the range 140–402 cm $s^{-1}$, with 1 Hz, 2.54 cm nominal amplitude, mechanically-generated sinusoidal water waves.

The mean velocity profiles have a log-linear form with a wake free-stream characteristic. The constant *C* which characterizes these profiles decreases with increasing wind speed, as a result of the variation of surface roughness condition between the transition region and the fully rough regime. The wave-associated stresses with their main component at twice the fundamental wave frequency were found to be significant. Therefore, the nonlinear terms encountered in the wave-induced Navier-Stokes equations associated with these stresses cannot be neglected, and linearization of the above equations is not permissible. The wave-induced velocity field and the wave-perturbed turbulence were found to depend significantly on the ratio of the wave speed to the mean free-stream wind velocity, $c/U_{\delta 0}$.

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