Abstract Submitted
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Mach-like capillary-gravity wakes MARC RABAUD, FREDERIC MOISY, Universite Paris-Sud — We determine experimentally the angle α of maximum wave amplitude in the far-field wake behind a vertical surface-piercing cylinder translated at constant velocity U for Bond numbers $Bo_D = D/\lambda_c$ ranging between 0.1 and 4.2, where D is the cylinder diameter and λ_c the capillary length. In all cases the wake angle is found to follow a Mach-like law at large velocity, $\alpha \sim U^{-1}$, but with different prefactors depending on the value of Bo_D. For small Bo_D (large capillary effects), the wake angle approximately follows the law $\alpha \simeq c_{\mathrm{g,min}}/U$, where $c_{\mathrm{g,min}}$ is the minimum group velocity of capillary-gravity waves. For larger Bo_D (weak capillary effects), we recover the law $\alpha \sim \sqrt{gD}/U$ found for ship wakes at large velocity. Using the general property of dispersive waves that the characteristic wavelength of the wavepacket emitted by a disturbance is of order of the disturbance size, we propose a simple model that describes the transition between these two Mach-like regimes as the Bond number is varied. This model, complemented by numerical simulations of the surface elevation induced by a moving Gaussian pressure disturbance, is in good agreement with experimental measurements.

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