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Accuracy of the 2D+t Approximation for a Laminar Wake in Surface Waves[1] LAURA PAULEY, CHRIS MATHIOT, Penn State University — Wakes in the ocean can be produced by a stationary object in a current or by a moving object in stationary water. When viewed in a reference frame moving with the object, the wake can persist thousands of object diameters downstream. Due to the extensive domain, an unsteady two-dimensional (2D+t) computation is often used to sweep downstream through the wake development. The 2D+t computation approximates the development of the wake at a fixed location as an object moves past but applies cyclical boundary conditions in the streamwise direction. A Parabolized Navier-Stokes (PNS) method has the same numerical efficiency as the 2D+t method but includes additional streamwise gradient terms found in the three-dimensional governing equations. The present paper investigates the accuracy of the 2D+t approximation for a laminar wake interacting with a surface wave described by the Stokes drift velocity distribution. When the laminar wake and Stokes drift are in the same direction, a secondary recirculating flow develops in the cross-span plane. The 2D+t results are compared with results from 3D Navier-Stokes computations and results from PNS computations to identify criteria at which the 2D+t method will yield accurate results.

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