A comparative study of two fast nonlinear free-surface water wave models - DTU Orbit
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This paper presents a comparison in terms of accuracy and efficiency between two fully nonlinear potential flow solvers for the solution of gravity wave propagation. One model is based on the high-order spectral (HOS) method, whereas the second model is the high-order finite difference model OceanWave3D. Although both models solve the nonlinear potential flow problem, they make use of two different approaches. The HOS model uses a modal expansion in the vertical direction to collapse the numerical solution to the two-dimensional horizontal plane. On the other hand, the finite difference model simply directly solves the three-dimensional problem. Both models have been well validated on standard test cases and shown to exhibit attractive convergence properties and an optimal scaling of the computational effort with increasing problem size. These two models are compared for solution of a typical problem: propagation of highly nonlinear periodic waves on a finite constant-depth domain. The HOS model is found to be more efficient than OceanWave3D with a difference dependent on the level of accuracy needed as well as the wave steepness. Also, the higher the order of the finite difference schemes used in OceanWave3D, the closer the results come to the HOS model.

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