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Numerical Simulation of a Seaway with Breaking DOUGLAS DOMMERMUTH, THOMAS O'SHEA, KYLE BRUCKER, DONALD WYATT, Naval Hydrodynamics Division, Science Applications International Corporation — The focus of this presentation is to describe the recent efforts to simulate a fully non-linear seaway with breaking by using a high-order spectral (HOS) solution of the free-surface boundary value problem to drive a three-dimensional Volume of Fluid (VOF) solution. Historically, the two main types of simulations to simulate free-surface flows are the boundary integral equations method (BIEM) and high-order spectral (HOS) methods. BIEM calculations fail at the point at which the surface impacts upon itself, if not sooner, and HOS methods can only simulate a single valued free-surface. Both also employ a single-phase approximation in which the effects of the air on the water are neglected. Due to these limitations they are unable to simulate breaking waves and air entrainment. The Volume of Fluid (VOF) method on the other hand is suitable for modeling breaking waves and air entrainment. However it is computationally intractable to generate a realistic non-linear sea-state. Here, we use the HOS solution to quickly drive, or nudge, the VOF solution into a non-linear state. The computational strategies, mathematical formulation, and numerical implementation will be discussed. The results of the VOF simulation of a seaway with breaking will also be presented, and compared to the single phase, single valued HOS results.

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