Abstract Submitted
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Hybrid fully nonlinear BEM-LBM numerical wave tank with applications in naval hydrodynamics[1] AMIN MIVEHCHI, STEPHAN T. GRILLI, JASON M. DAHL, Univ. of Rhode Island, CHRIS M. OREILLY, Univ. of Rhode Island Navatek Ltd., JEFFREY C. HARRIS, KONSTANTIN KUZNETSOV, Univ. of Paris-Est, Chatou, France, CHRISTIAN F. JANSSEN, Humburg Univ.of Technology (TUHH),Germany — simulation of the complex dynamics response of ships in waves is typically modeled by nonlinear potential flow theory, usually solved with a higher order BEM. In some cases, the viscous/turbulent effects around a structure and in its wake need to be accurately modeled to capture the salient physics of the problem. Here, we present a fully 3D model based on a hybrid perturbation method. In this method, the velocity and pressure are decomposed as the sum of an inviscid flow and viscous perturbation. The inviscid part is solved over the whole domain using a BEM based on cubic spline element. These inviscid results are then used to force a near-field perturbation solution on a smaller domain size, which is solved with a NS model based on LBM-LES , and implemented on GPUs. The BEM solution for large grids is greatly accelerated by using a parallelized FMM,which is efficiently implemented on large and small clusters, yielding an almost linear scaling with the number of unknowns. A new representation of corners and edges is implemented, which improves the global accuracy of the BEM solver, particularly for moving boundaries. We present model results and the recent improvements of the BEM, alongside results of the hybrid model, for applications to problems.

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