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# An efficient flexible-order model for coastal and ocean water waves

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Current work are directed toward the development of an improved numerical 3D model for fully nonlinear potential water waves over arbitrary depths. The model is high-order accurate, robust and efficient for large-scale problems, and support will be included for flexibility in the description of structures. The mathemathical equations for potential waves in the physical domain is transformed through $\sigma$-mapping(s) to a time-invariant boundary-fitted domain which then becomes a basis for an efficient solution strategy. The improved 3D numerical model is based on a finite difference method as in the original works [3, 1]. The new and improved approach employs a GMRES solver with multigrid preconditioning to achieve optimal scaling of the overall solution effort, i.e., directly with $n$ the total number of grid points. A robust method is achieved through a special treatment of the boundary conditions along solid boundaries, and is necessary for a robust multigrid preconditioning strategy. Full details and other aspects of the 3D solution will appear in [2]. At the symposium, we will present examples demonstrating the fundamental properties of the numerical model together with the latests achievements.

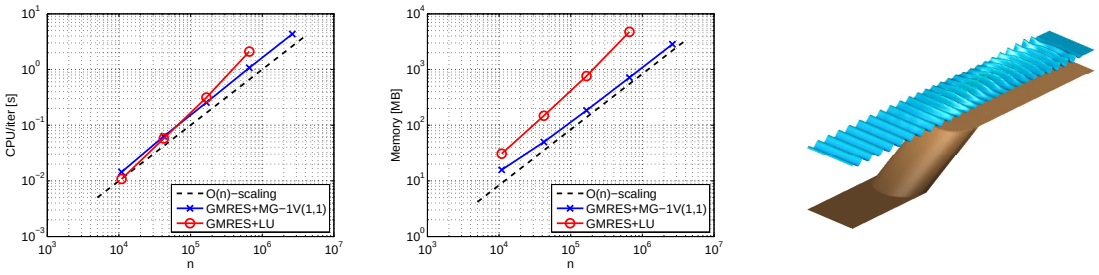


Figure 1: a) Scaling of computational effort. b) RAM memory use. c) Computed snapshot at t=50s for the experiments of Whalin at wave period T=1s.

## References

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