Master Thesis Project proposal

Connectable grids in a real-time waves simulator.

Problem description

Maneuvering fast small ships in heavy sea states can be incredibly dangerous and tough. To avoid injuries and to reduce cost and material damage, MARIN is developing a Fast Small Ship Simulator (FSSS) in which military personnel can be trained in a wide variety of circumstances. Examples of simulation scenarios are beach landings, entering a pirated ship or maneuvering into the dock of another ship.

The software to simulate the waves in these scenarios is based on the Variational Boussinesq Model (VBM)[Klopman 2010], implemented with the aim to simulate the waves as accurate as possible within the real-time constraint. This is currently achieved by employing an equidistant grid and a highly-optimized GPU implementation.

Project goals

To increase the practical applications of VBM, a multiple GPU strategy is employed where each GPU contains a single VBM grid. The grids communicate together through an overset grid protocol. A particular challenge in this overset grid is to accurately solve the elliptic dispersion equation. Due to the real-time constraint a global elliptic equation must be solved locally on each grid. The error due to this local approach introduces non-physical homogenous functions at the overset-grid boundaries. The aim of this project is to develop a fast method to filter out these homogenous solutions.

Subtasks

1. Familiarization with the mathematical VBM model.
2. Familiarization with the VBM code (CPU and later GPU).
3. Development and implementation (CPU) of the filter.
4. Writing thesis and presenting the results.

Contact

For more information about this project, please contact M.P. van Schrojenstein Lantman (m.lantman@marin.nl) or C. Vuik (c.vuik@tudelft.nl). The project will be co-supervised by him and S. Boonstra from the Maritime Research Institute Netherlands and C. Vuik from the TU Delft.

Bibliography

Klopman, G. (2010). *Variational Boussinesq modelling of surface gravity waves over bathymetry*. Wohrmann Print Service. https://doi.org/10.3990/1.9789036530378