Real-Time Simulation of Ship-Structure and Ship-Ship Interaction

This paper gives the status of the development of a ship-hydrodynamic model for real-time ship-wave calculation and ship-structure and ship-ship interaction in a full mission marine simulator. The hydrodynamic model is based on potential flow theory, linear or non-linear free surface boundary condition and higher-order accurate numerical approximations. The equations presented facilitate both Neumann-Kelvin and double-body linearizations. The body boundary condition on the ship hull is approximated by a static and dynamic moving pressure distribution. The pressure distribution method is used, because it is simple, easy to implement and computationally efficient. Multiple many-core graphical processing units (GPUs) are used for parallel execution and the model is implemented using a combination of C/C++, CUDA and MPI. Two ship hydrodynamic cases are presented: Kriso Container Carrier at steady forward speed and lock entrance of a TEU 12,000 Container Carrier. These calculations reveal that the pressure distribution model is a too simple approximation of the body boundary condition and that it has the limitations of a flat-ship approximation. It is necessary to investigate more accurate approximations of the body boundary condition, which does not compromise the overall computational efficiency.

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