Energy Efficient Safe SHip OPERAtion

Status task 2.2

WP2, task 2.2

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Task 2.2

- Partners:
  - DNV (7MM)
  - GL (10MM)
  - IST (5MM)
  - NTUA (9MM)
  - RINA (6.5MM)
  - LR (0.5MM)
  - DTU (10MM)
- Totally 48 man months

GL

- Code: GLcourse
- Manoeuvring simulator based on Abkowitz model
- Improvements:
  - Drift forces due to wind and waves
  - Rudder in propeller race
  - Propeller curves
  - Engine model
- Typical applications: manoeuvring in calm water and waves
- Applicability: two time-scale approach, i.e. applications where relevant wave encounter frequencies are sufficiently large
- Schedule:
  - Running: PMM simulations for KVLCC2 and DTC
  - Next: PMM post-processing code and implementation of Abkowitz

NTUA

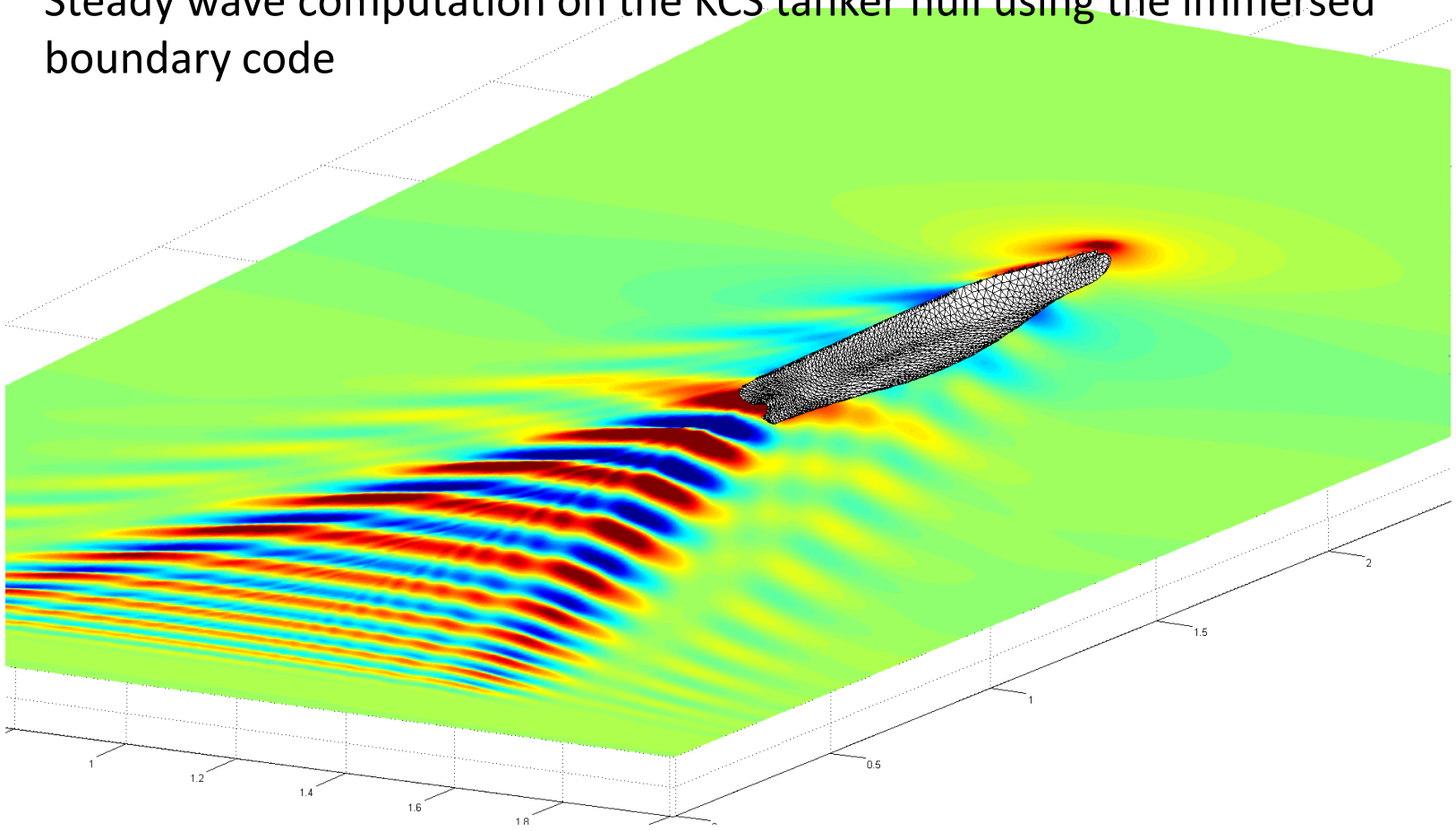
- Code: HYBRID_MAN
- Time domain ship maneuverability in waves in Simulink
- Improvements:
  - Coupling of NTUA-SDL's HYBRID time domain seakeeping code with manoeuvring model in Simulink
- Typical applications: manoeuvring in calm water and wind and waves
- Schedule:
  - Linear and alternative nonlinear manoeuvring models in calm water being tested
  - Next: Linear model with waves M15
  - Next: Nonlinear model with waves M24

DTU

- Code: OceanWave3D
- High-order finite difference based potential flow solver using either overlapping boundary-fitted structured meshes or an immersed boundary technique to resolve the ship hull
- Improvements:
  - Overlapping grid code: Validated for linear seakeeping and added resistance calculations using both the Neumann-Kelvin and double-body flow linearization
  - Immersed boundary code: A new automated derivation procedure has been developed for implementing arbitrarily high-order Weighted Essentially Non-Oscillatory (WENO) schemes on uniform and non-uniform finite difference grids. Such a WENO treatment of the convective terms in the nonlinear, forward-speed free surface boundary conditions is shown to be robust and stable for all combinations of ship speed and wave celerity. This paves the way to extending the code to nonlinear wave-ship interaction.
- Typical applications: linear seakeeping and added resistance
- Schedule:
  - Paper on WENO soon
  - Next: parallel implementation. Immersed boundary code and preliminary fully nonlinear, forced motions problems will be considered

DTU

- Code: OceanWave3D
- Steady wave computation on the KCS tanker hull using the immersed boundary code



DNV

- Code: WAQUM2
- Unified model of manoeuvring, seakeeping and added resistance in a seaway
- Improvements:
  - Retardation functions for fluid memory effects at forward speed
  - Added resistance/ drift forces
  - Manoeuvring model
  - Propeller and rudder model
- Typical applications: manoeuvring in waves
- Schedule:
  - 90% coded for first step, but still need QA: manoeuvring with mean drift forces
  - Second step: fully nonlinear restoring and Froude Kriloff time dependent contributions to drift force
  - Third step: (maybe too optimistic) even more of the mean drift forces made time dependent

The end

- Thanks for your attention.