ABSTRACT
This poster presents the capabilities of the OpenFOAM’s Naval Hydro pack for marine hydrodynamics CFD simulations developed within Prof. Jasak’s CFD group.

The CFD model is used for accurate simulations regarding:
- Steady resistance with dynamic sinkage and trim,
- Seakeeping in head and oblique, regular and irregular sea states,
- Self propulsion with modelled and discretised propellers,

Versatile, robust and efficient simulations are enabled with:
- Ghost–Fluid–Method: accurate treatment of discontinuities at the free surface,
- Interface capturing: Volume–of–Fluid or Level Set Method,
- Solution decomposition: calculating perturbation around potential flow solution,
- Domain decomposition: preventing wave reflection,
- Semi–monolithic approach: implicitly coupled pressure equation and rigid body equations.

Steady resistance simulations
Rapid steady resistance simulations are routinely performed to aid the design of ships in order to minimize fuel consumption. Image presents wave elevation for three different bow shapes, where the results have been obtained within twelve hours, including meshing, case set–up, simulations and post processing.

Seakeeping simulations
Fully non–linear CFD seakeeping simulations are becoming increasingly utilised because of their ability to accurately calculate added resistance of ship in waves. Reliable estimate of transfer function can be obtained within few days using a modest HPC workstation (64 CPUs).

Actuator disk model allows fast CFD simulations of different manoeuvres. Using the actuator disk model and deflected rudder, tactical diameter of the KVLCC model has been calculated.

Conclusion
With increasing availability of computational resources, CFD for marine hydrodynamics is gaining in popularity and slowly replacing traditional methods: experiments and potential flow based numerical methods.

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Full scale self–propulsion
One of the main benefits of CFD is its ability to calculate full scale flows without the need for error prone extrapolation of results. The Naval Hydro pack has been recently used to calculate the self–propulsion point for a 138 meters long general cargo carrier with constant propeller revolution rate.

Manoeuvring: turning circle
Actuator disk model allows fast CFD simulations of different manoeuvres. Using the actuator disk model and deflected rudder, tactical diameter of the KVLCC model has been calculated.