

VeSim

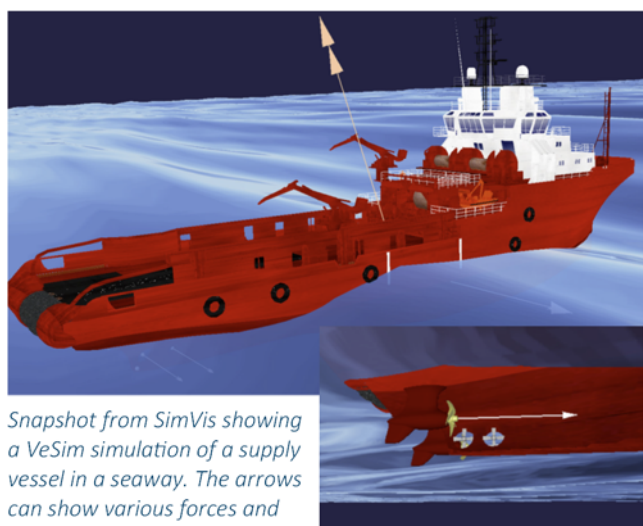
Vessel simulator VeSim combining manoeuvring and seakeeping

The SINTEF Ocean Vessel Simulator (VeSim) is a time-domain simulation tool for the simulation of ships in a seaway with variable heading and speed. The simulator has been developed in the course of several research projects during the past years and is still under continuous improvement. All of its hydrodynamic modules are based on years of experience in numerical modelling at SINTEF Ocean.

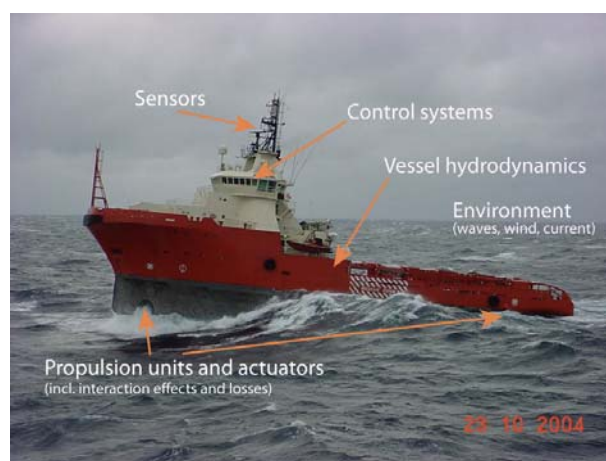
One of the principal challenges in the development of the simulator has been to combine manoeuvring and seakeeping into one common simulation code. Traditionally, these two fields have been treated separately. Manoeuvring has been simulated in calm water only, and seakeeping has been studied at constant forward speed and heading. Creating a unified formulation of the hydrodynamics that link these two disciplines has been a key aim in the development of VeSim, as it should be able to handle not only a vessel in DP operations or calm water manoeuvring, but actual manoeuvres at sea in rough conditions.

The external forces from waves, wind and current are modelled, including effects such as short-crested irregular waves and the

effects of wind gusts. Propulsion units such as propeller and rudder, tunnel thrusters, etc. including loss effects due to ventilation, hull interaction and interaction between thrusters are also modelled, as this has been one of the areas of focus during the past few years. Typical sensors onboard a ship, such as GPS, MRU and gyrocompass are modelled, enabling hardware-in-the-loop testing of control systems, where the hardware can receive sensor signals as if it were on board a real ship and pass control signals back to the simulation software.



Snapshot from SimVis showing a VeSim simulation of a supply vessel in a seaway. The arrows can show various forces and moments acting on the vessel and offer the end users and developers an excellent way of checking and understanding the physics in the numerical models as well as being a tool for communicating complex results to people from other disciplines. Inlay: View at the main propulsion units. Arrows denote forward thrust.

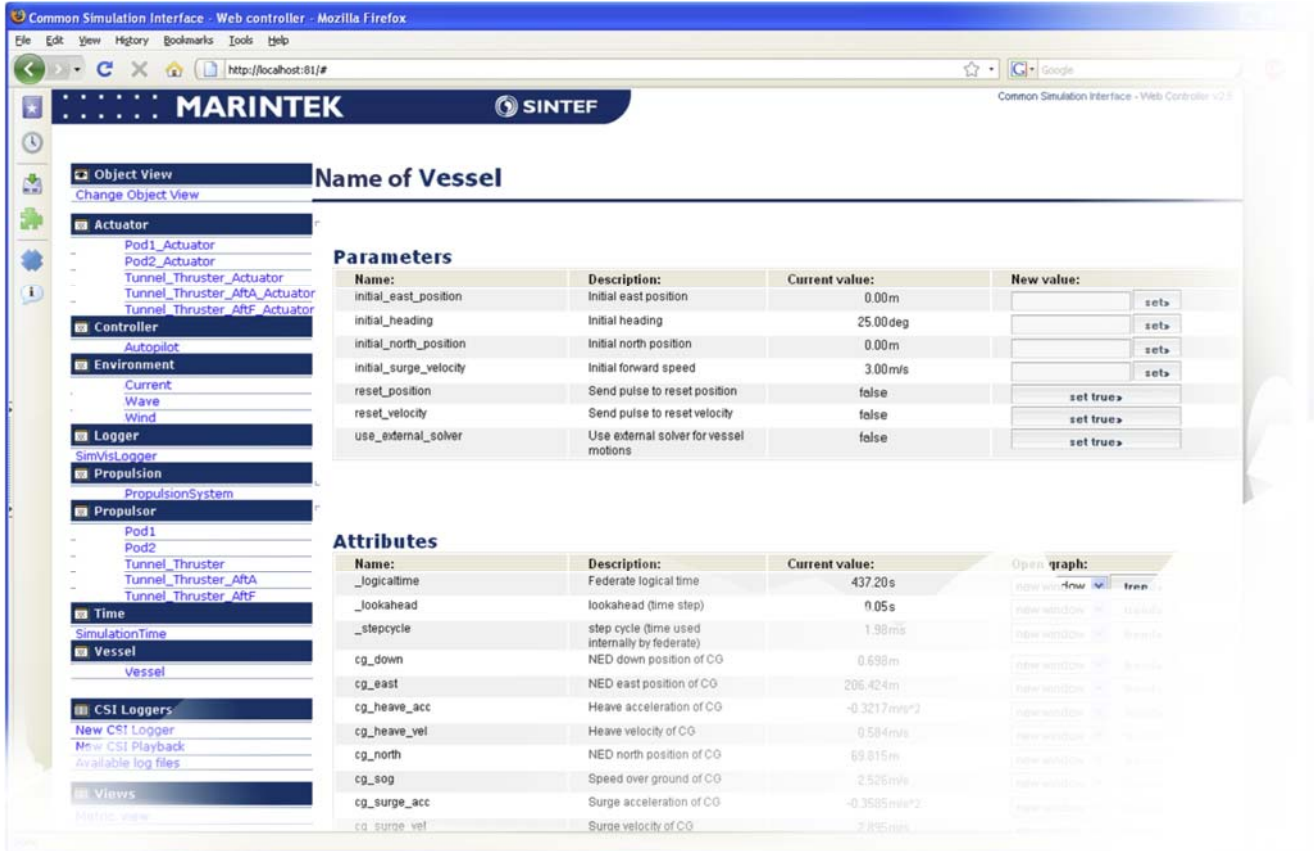


The simulator can be configured using SINTE Oceans hydrodynamic workbench ShipX, in which the numerical model of the ship can be computed and propulsion units, sensors etc can be defined and the simulation scenario set up. A simple scripting language that enables the end-user to set up customized simulation scenarios with events happening at specified time instances has been developed.

The simulation infrastructure allows other software or hardware to be connected to the simulation. The simulation can also be divided among several computers if necessary. This black box" thinking creates an arena for different parties to interact within a

simulation without having to disclose any company-sensitive information. This kind of coupling has been performed for example against MATLAB code and other third-party code as well as against control hardware and laboratory equipment.

VeSim includes full 3D visualization using SINTEF Oceans SIMVIS visualisation package. All input for the visualization can be set up automatically in ShipX, including hull geometry and propulsion units (propellers, rudders, pod housing etc).



A web browser gives easy access to viewing simulation values and changing input parameters online.