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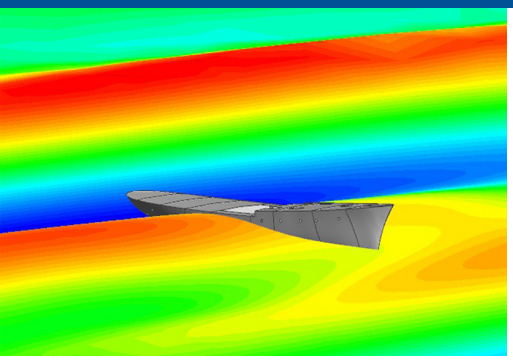
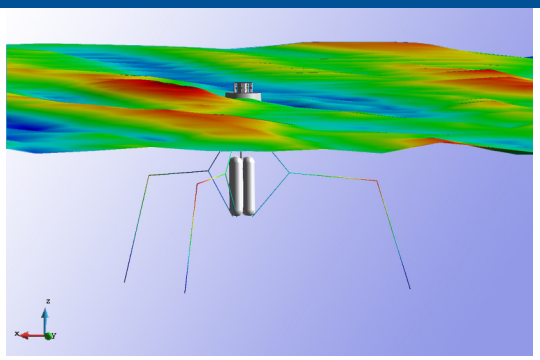
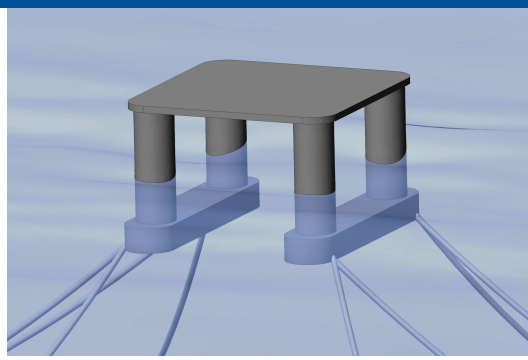
SeaFEM







SeaFEM INTRODUCTION

SeaFEM is a suite of tools for the computational analysis of the effect of waves, wind and currents on ships and offshore structures, as well as for maneuvering studies. SeaFEM applications include ships, spar platforms, FPSO systems, semi-submersibles, TLPs, marine wind turbines and ocean energy harnessing devices. The wide range of analysis capabilities available in SeaFEM enables the assessment of different design alternatives, significantly reducing overall project costs and timescales.

SeaFEM includes state-of-the-art radiation and diffraction BEM and FEM solvers, enabling frequency domain and direct time-domain analyses of the dynamic response of the structure. Furthermore, SeaFEM is integrated in the Tdyn environment, allowing seamless connection with the FEM structural solver RamSeries, to perform hydroelastic studies.

The different tools available in SeaFEM are fully integrated in an advanced graphic user interface (GUI), for geometry and data definition, automatic mesh generation and visualizing the analysis results. SeaFEM GUI features a versatile tree-like interface for data managing, allowing an easy control of the whole process of entering the analysis data.

To facilitate the data definition process, SeaFEM provides tools to easily configure the type of the analysis to be carried out (seakeeping, extinction tests, RAOs, turning circle, towing or hydroelasticity). Furthermore, SeaFEM provides a variety of tools which allow having a perfect control over the process and assess its quality.

SeaFEM's TECHNICAL FEATURES

SeaFEM has been developed for the most realistic simulations of three-dimensional multi-body radiation and diffraction problems, by solving potential flow equations in the time domain, using the Finite Element Method (FEM) on un-structured meshes. This is highly recommended for the simulation of complex geometries in large and deep domains, and for considering non-linear phenomena or multi-body studies in the analysis. In fact, SeaFEM time-domain simulations can efficiently handle non-linear hydrodynamics effects due to waves, variable wetted surface, wave impact on the structure, as well as real forward speed or current effects.

SeaFEM also features a linear frequency-domain solver based on the Boundary Element Method (BEM), offering a quick solution adequate for screening design alternatives or undertaking initial studies.

SeaFEM has been conceived to simulate the seakeeping ability of ships and offshore structures, as well as calculating the loads due to waves and currents. Moreover, the software has been equipped with the capability of introducing any type of external loads acting over the structure. Effects of mooring lines can be simulated by using the built-in models.

SeaFEM is also able to analyse pressurized free surfaces. This capability provides the user with the tools for simulating complex devices such as air-cushion vehicles and wave energy converters based on the oscillating water column principle.

The CUDA© - GPU library, the Deflated Conjugated Gradient and Direct Sparse solvers allow SeaFEM to carry out direct time-domain simulations at full size much faster than real time.

SeaFEM's multi-body functionality offers a rich range of connections between bodies, including rotation, line and plane constraints, rotation and translation links, and rigid body, ball, revolute, cylindrical and prismatic joints.

CAPABILITIES CHART (BASIC MODULE)	
FEM direct time domain multi-body wave diffraction - radiation solver	✓
BEM frequency domain multi-body linear wave diffraction - radiation solver	✓
Real forward speed with stream-line and SUPG integration	✓
Seakeeping, towing, maneuvering, extinction tests and RAOs	✓
Nonlinear hydrodynamics, drift effects and transom stern flows	✓
1st order Stokes regular and spectral waves, including user defined spectrum	✓
Bathymetry: constant or infinite depth, and irregular seabed	✓
User-defined external forces and physical connections	✓
Build-in multi-segment quasi-static catenary mooring model	✓
Cutting-edge direct sparse and deflated CG solvers. CUDA GPU acceleration available	✓
Advanced Tcl programming interface	✓

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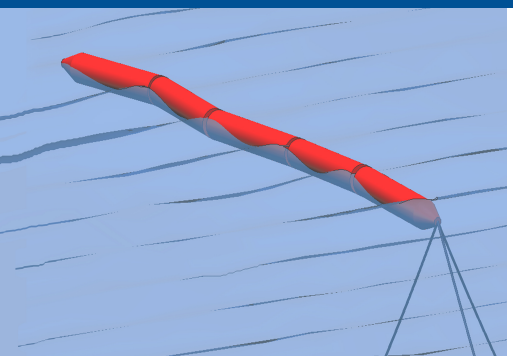

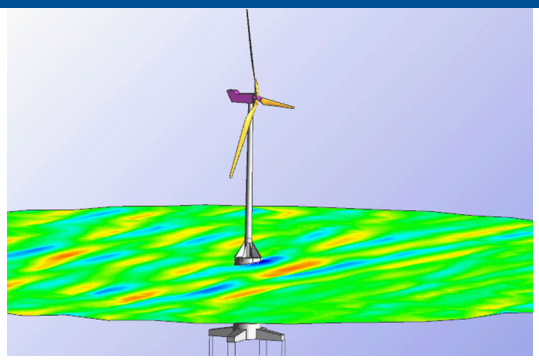

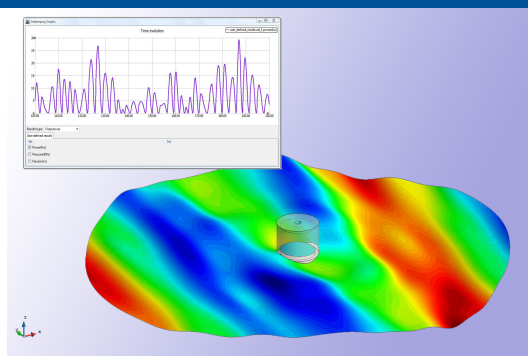

SeaFEM's Advanced module features the latest technology for solving second order wave diffraction-radiation equations with real sea spectra. It also allows adding non-linear forces acting on slender elements (Morison-type forces) and includes a FEM dynamic cable multi-segment model for the most realistic analyses of mooring systems.

SeaFEM Advanced module is linked to Tdyn suite's structural solver, RamSeries, allowing seamless communication of the hydrodynamic forces to the structure, to perform the most reliable fatigue assessment studies. This capability is powered by the cutting-edge FEM technology available in Tdyn's structural solver, Ramseries.

CAPABILITIES CHART (ADVANCED MODULE)	
2nd order Stokes regular and spectral waves, including user defined spectrum	✓
Hydro-elasticity solver for strength and fatigue assessment	✓
Drag, added mass, friction and lift forces on slender elements using Morison formula	✓
Multi-segment dynamic FEM cable mooring model	✓
Simulink® interface (coming soon)	✓

Thanks to its advanced pre-processing capabilities, based on Tdyn suite's GUI, SeaFEM can easily model complex geometric structures with a best-in-class model preparation time. Additionally, SeaFEM can import standard CAD files, and has direct connection with some popular CAD packages. This way, it is not only possible to import the geometrical model but also the parts definition and the tree-like layers structure. Moreover, it is also possible to adapt the GUI, allowing the user to automate and simplify the analysis processes.

SeaFEM features a powerful TCL scripting extension, enabling access to advanced features, including writing customized results files, operations on internal structures and execution/ communication with external program by using a feature rich extension programming language.

SeaFEM APPLICATIONS

SeaFEM is a general-purpose hydrodynamics analysis tool that provides great flexibility to address most types of problems, including:

- Motion analysis of ships and offshore structures in different sea conditions
- Response amplitude operators RAOs
- Turning circle maneuver in irregular waves
- Evaluation of floating wind turbines platforms
- Concept design and assessment of wave energy converters
- Seakeeping analysis of offshore structures, including drag effects based on Morison formula
- Multiple body interactions during LNG transfer
- TLP tether analysis
- Strength assessment (hydroelasticity) of ships and offshore structures
- Evaluation of wave impact loading on offshore structures
- Design and analysis of mooring systems, including intermediate buoys and clump weights
- Fatigue verification of offshore structures
- Analysis of air-cushion vehicles in waves
- Motions analysis of FPSOs
- Determination of air gaps
- Discharging landing craft from mother ships
- Towing of large offshore structures using barges/ships

INFORMATION

For further information, please visit:

http://www.compassis.com/seafem

SeaFEM's autoinstallation package can be downloaded from SeaFEM's website. A one month trial password for evaluation purposes can be obtained at the same site. Furthermore, free non-commercial licences of SeaFEM calculation module are available upon request.

System requirements

Windows NT / XP / XP64 / Vista / Vista64 / 7 / 7 64-bit / 8 / 8 64-bit or Linux 32/64
Minimum requirements: 1.0 GB RAM (1.5 GB for 64 bits editions) and 500 MB of free hard disk space
Supports any graphics card with OpenGL acceleration
Supports CUDA GPU acceleration

For information about conditions and prices of commercial licences, please contact **info@compassis.com**

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