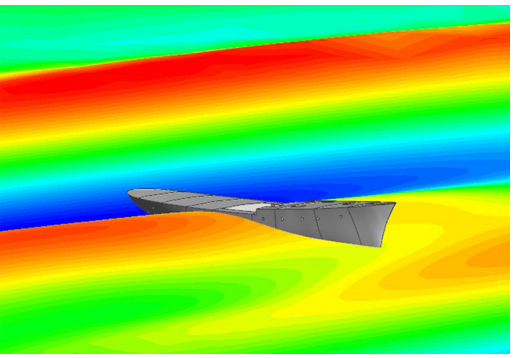
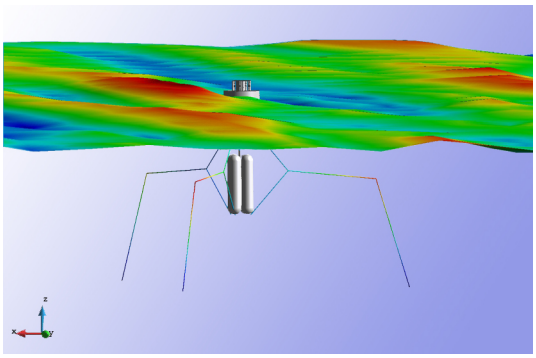
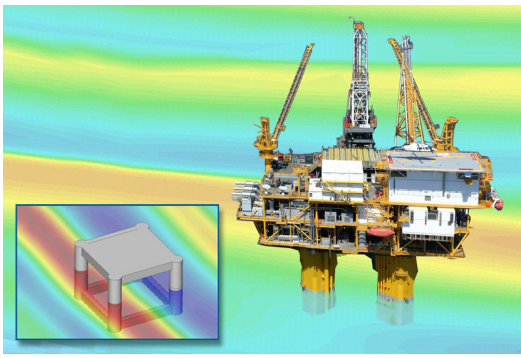
COMPASS
www.compassis.com

SeaFEM







SeaFEM INTRODUCTION

SeaFEM is a suite of tools for the computational analysis of the effect of waves, wind and currents on naval 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 a state-of-the-art radiation and diffraction solver, enabling direct time-domain analysis of the dynamic response of the structure. Furthermore, SeaFEM is integrated in the CompassFEM environment, allowing seamless connection with the FEM structural solver RamSeries, to perform one-way and two-way implicit fluid-structure interaction analyses.

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, maneuvering, towing or fluid-structure interaction). Furthermore, SeaFEM provides a variety of tools which allow having a perfect control over the process and assess its quality.

TECHNICAL FEATURES OF SeaFEM

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 on unstructured meshes. This is highly recommended for the simulation of complex geometries in large and deep domains, and for considering non-linear phenomena in the analysis or multi-body studies. In fact, SeaFEM time-domain simulations can efficiently handle non-linear hydrodynamics effects due to the variable wetted surface, wave impact on the structure, as well as real forward speed or current effects.

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

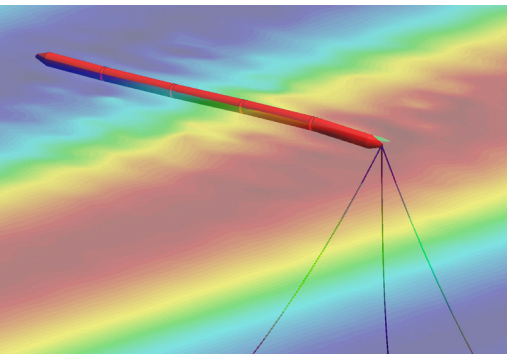
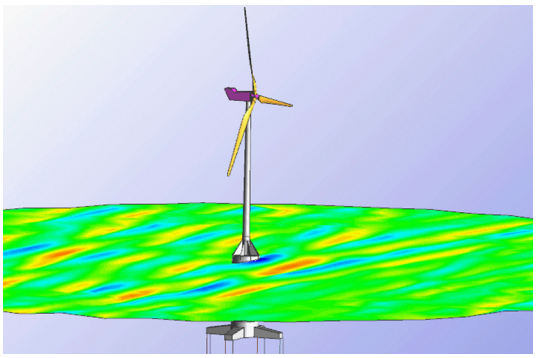
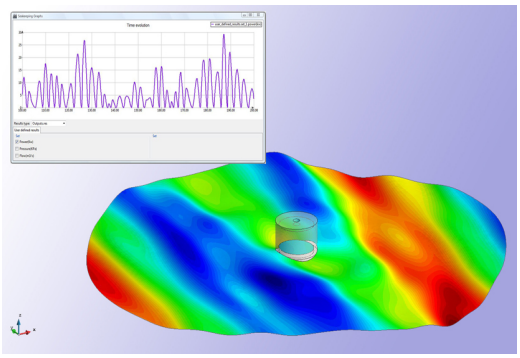
SeaFEM is also equipped with capabilities to simulate pressurized free surfaces. These capabilities provide the user with the tools for simulating complex devices such as air-cushion vehicles (surface effect ships, for instance) and wave energy converters based on the oscillating water column principle.

The CUDA© - GPU (Graphics Processing Unit) library and the Deflated Conjugated Gradient solver available in SeaFEM, are state of the art implementations aiming at reducing computational time. This leads to being capable of carrying out free floating simulations at full size much faster than real time.

CAPABILITIES CHART	
3D Time domain FEM multi-body wave diffraction and radiation	✓
Real forward speed with stream-line integration	✓
Seakeeping, towing, maneuvering, extinction tests and RAOs	✓
Nonlinear hydrodynamics, slow drift effects and transom stern flows	✓
Regular and irregular (spectral) waves, including user defined spectrum	✓
Bathymetry: infinite depth, constant depth and irregular seabed	✓
Strength and fatigue assessment (DNV-RP-C203, API RP 2A-WSD)	✓
External forces and physical connections (linear and non-linear)	✓
Build-in quasi-static non-linear catenary and multi-segment catenary	✓
Coupled structural analysis for non-linear cable modelling	✓
Cutting-edge deflated CG solvers. CUDA GPU acceleration available	✓
Advanced Tcl programming interface	✓

Thanks to its advanced pre-processing capabilities, based on Compass FEM suite's GUI, SeaFEM can easily model complex geometric structures with a best-in-class model preparation

Compass Ingeniería y Sistemas http://www.compassis.com
Tel.: +34 932 181 989 - Fax.: +34 933 969 746 - E: info@compassis.com - C/ Tuset 8, 7o 2a, Barcelona 08006 (Spain)

time. Additionally, SeaFEM 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 is coupled with Compass FEM's structural solver, Ramseries, allowing seamless one-way and two-way implicit structure-waves interaction analyses (hydroelasticity) including tools for strength and fatigue assessment of the design (DNV-RP-C203, API RP 2A-WSD).

Furthermore, SeaFEM features a powerful scripting extension, enabling users to enhance simulations without recourse to external compiled subroutines. SeaFEM Tcl interface allows 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 spectra
- Response amplitude operators RAOs with white noise spectrum
- Turning circle maneuver in irregular waves
- Evaluation of floating wind turbines platforms
- Concept design and analysis of wave and wind energy systems
- Seakeeping analysis of offshore structures, including drag effects based on Morison equation
- Multiple body interactions during LNG transfer
- TLP tether analysis
- Fluid-structure interaction analysis (hydro-elasticity) of ships and offshore structures
- Analysis of air-cushion vehicles in waves
- Evaluation of wave loading on lower decks of offshore structures
- Strength and fatigue assessment of offshore structures (DNV-RP-C203, API RP 2A-WSD)
- Design and analysis of mooring systems, including intermediate buoys and clump weights
- Motions analysis of FPSOs
- Determination of air gaps
- Estimation of power take out of a wave energy converters, including oscillating water column devices
- Discharging landing craft from mother ships
- Transportation of large offshore structures using barges/ships

INFORMATION

For further information, please visit:

http://www.compassis.com/seafem

A free version of SeaFEM, limited in the number of mesh nodes, can be downloaded from the SeaFEM website. A one month trial password for activating all the capabilities for demo purposes can be obtained at the same site.
Furthermore, free non-commercial licences of SeaFEM calculation module are available upon request. The terms and conditions of this free licence and the application form can be retrieved from the SeaFEM website.

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 (required any CUDA-enabled and double precision GPU)

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