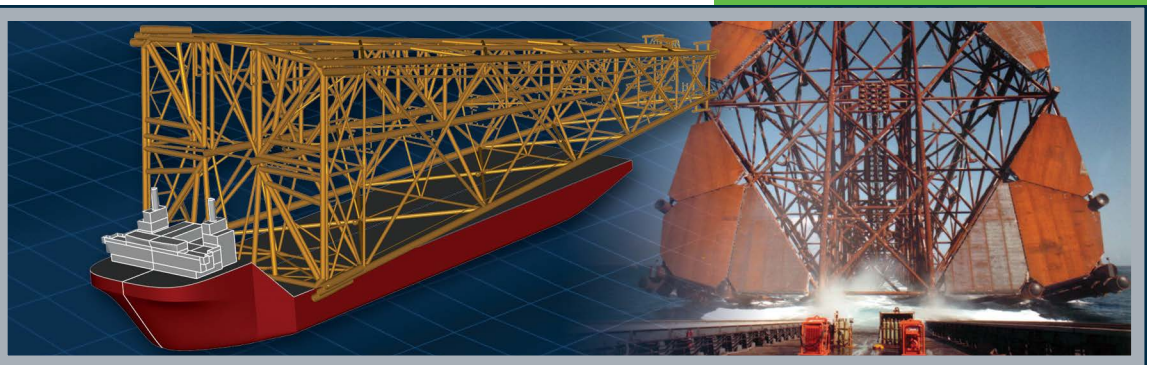
PRODUCT DATA SHEET



MOSES

Hydrostatic and Hydrodynamic Analysis Software for Offshore Installation and Platform Design

MOSES is an advanced suite of hydrostatic and hydrodynamic software that provides for the accurate calculation and simulation of offshore floating systems. Its analysis capabilities and scripting language can be applied in the frequency domain and time domain for both installation problems and in-place analysis of FPSOs and floating platforms. More than 30 years of focus on these specialized requirements have made MOSES the analysis mainstay for most of the world's offshore installation projects. MOSES is available in three suites to suit all design office requirements: MOSES Enterprise, MOSES Advanced, and MOSES.

MOSES Enterprise:

Stability, Motions, Mooring, Structures, and Launch

The MOSES Enterprise suite provides a complete range of functions, from modeling of hulls and calculation of stability, to prediction of motions, mooring analysis, structural analysis, and jacket launch. This suite can be used for new or existing FPSO and platform studies, as well as for transportation and installation analysis. The software can import SACS models of topsides or cargo structures.

MOSES Advanced:

Stability, Motions, Mooring, and Structures

The MOSES Advanced suite provides both frequency domain and time domain prediction of vessel motions. This can be applied using either strip theory or radiation-diffraction panel methods of calculation. Mooring lines can be integrated including large displacement effects of mooring line deformations. The structural solver allows for structural analysis of topside structures or structural cargo.

MOSES:

Stability and Motions

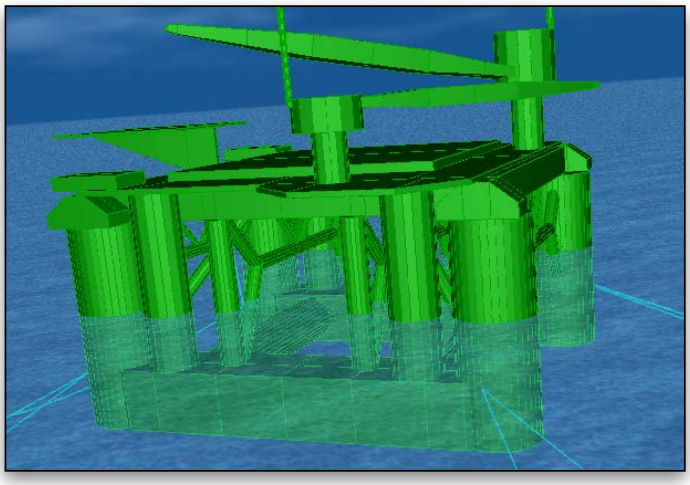
The MOSES suite provides a highly capable and cost-effective package for stability assessment and motions analysis in the frequency domain. By providing both strip theory and radiation-diffraction analysis methods, it can accurately predict motions of vessels and floating platforms.

MODULES:

MOSES Solver

All three suites include the MOSES Solver and MOSES Language modules – the platform on which all analysis capabilities depend. The unique, generalized solver allows the consideration of all types of forces acting on the floating system including hydrostatic, hydrodynamic, inertial, and mooring forces. The solver supports model inputs including section or panel definition of hull shapes, Morison elements, various kinds of taut or catenary mooring lines as well as beam and plate elements.

Connectors in MOSES are particularly flexible and effective. They provide a generalized way of describing connections between floating bodies, or to the ground, and include catenary mooring lines, tension- and compression-only nonlinear springs, rigid connectors such as pins and launchways, and even true nonlinear rod elements.



MOSES can compute motions and stability of any vessel or platform.

MOSES Language

The MOSES scripting language provides a unique, flexible, and powerful way of specifying system behavior and performing a series of analyses to consider different installation or operational conditions. In addition to providing specialized capabilities, the MOSES language is rich in general utilities for interactive reporting, graphing, viewing 3D models, and statistical interpretation.

- Model generation with validity checking
- Run complex analyses with a single command
- Database capability with restart options
- Customizable reporting scripts
- Macros, loops, and conditional execution

Strip Theory

Strip theory provides a fast and proven way of predicting the motions of vessels. It is well suited for barge transports and any vessel that is slender in its L/B (length/beam) ratio.

- Easy input of common section shapes
- RAOs (response amplitude operators) at CG (center of gravity) or remote locations
- Standard and user defined spectra
- Statistical multipliers or storm duration definition

System Requirements

Processor:
Intel Core 2 or faster

Operating System:
Microsoft Windows 7 or 8

RAM:
Minimum 2 GB of RAM

Disk Space:
Minimum 10 GB of free disk space

Display:
Graphics card supporting Open GL, with minimum 256 MB RAM and 1280x1024 or higher resolution

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Basic Connectors

The Basic Connectors module provides a generalized way of modeling lifting slings, anchor lines, mooring lines, non-linear springs, pins, fenders, and any other item that connects two bodies together or connects a body to the ground. Connectors can be tension-only or compression-only and custom connectors can be defined.

- Lift, lower, or upend with multiple slings and hooks
- Activate or deactivate to simulate breaking or re-rigging
- Move anchors to achieve a specified tension
- Hold hooks at elevation or load while flooding or pumping
- Catenary mooring lines with buoys or clump weights
- Nonlinear springs can act in either tension- or compression-only
- Gaps, pins, and lines provide constraints to motion
- Spectral fatigue in connectors can be accumulated

3D Diffraction

Prediction of motions for non-ship shaped hulls and for situations in which surge is important. Adaptive meshing automatically increases panel mesh density as required.

- Import of PLY files from Rhino and other software
- Non-linear, slowly varying, wave drift forces

Time Domain

The Time Domain module can perform a time history simulation on any single or multi-body system. Starting from the frequency domain results, and taking into account mooring, current and wave forces, the Time Domain module provides fast computation of full system response. Customizable reporting and automatic generation of system response animations allow easy understanding and communication of results.

- Environment of current, irregular waves, and/or wind
- Multiple body motions can be analyzed
- Vortex shedding in wind or water is computed
- Restart capability allows continuation of analysis
- Statistics of results can be computed
- Dynamic tank flooding and emptying

Pipe & Rod Elements

When analyzing mooring line dynamics, the Pipe & Rod module allows accurate calculation of mooring line response taking into account large deflections. This allows modeling and analysis of anchor lines, mooring lines, TLP (tension leg platform) tendons, rigid risers, and pipelines.

- Large deflection beam capability
- Handles TLP tendons, rigid risers, and pipelines
- Mooring line dynamics are included
- Combine pipe assemblies with rollers

Structural Solver

The Structural Solver module enables structural analysis and spectral fatigue of topside or cargo structures. It supports beam and plate elements and can import structures from SACS.

- Linear and non-linear analysis
- Frequency domain stress analysis
- Modal analysis using subspace iteration
- Code checking to API, AISC, NORSOK, and ISO

Jacket Launch

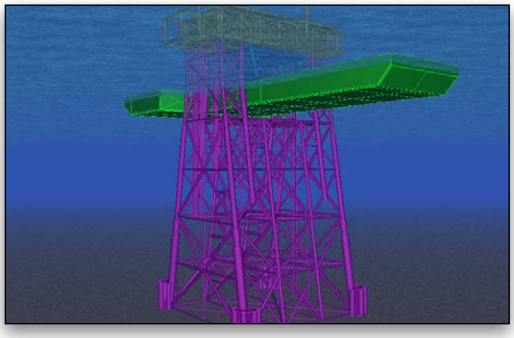
The Jacket Launch module can be used to perform a six-degree-of-freedom time domain simulation of a jacket launch from a barge into water.

- Automated ballasting
- Winch and friction definitions
- Optional side launch

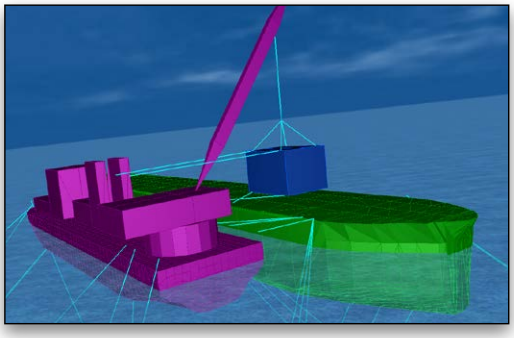
Generalized Degrees of Freedom

The Generalized Degrees of Freedom module is used to consider the effect of structural deformation and flexibility on buoyancy, frequency response, and loadout calculations. It can also be used to consider the hydrodynamic interaction between two vessels.

	Suites		
Module	MOSES	MOSES Advanced	MOSES Enterprise
MOSES Solver	✓	✓	✓
MOSES Language	✓	✓	✓
Strip Theory	✓	✓	✓
Basic Connectors	✓	✓	✓
3D Diffraction	✓	✓	✓
Time Domain		✓	✓
Pipe & Rod		✓	✓
Structural Solver		✓	✓
Jacket Launch			✓
Generalized Degrees of Freedom			✓



Installation Analysis
• Stability and upending analysis • Floatover
• Lifting • Ballasting • Jacket launch



Multi-body Lifting Simulation
• Time domain simulation • Multiple moorings and slings
• Body-body interaction • Animations for visualization

Bentley
Sustaining Infrastructure