Bentley
Advancing Infrastructure

CONNECT Edition

MOSES

Hydrostatic and Hydrodynamic Analysis Software for Offshore Installation and Platform Design

MOSES is advanced 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 packages to suit all design office requirements: MOSES, MOSES Advanced, and MOSES Enterprise.

MOSES:

Stability and Motions

The MOSES package provides a highly capable and cost-effective package for stability assessment and motions analysis in the frequency domain. Hull and compartment modeling is included along with both strip theory and 3D diffraction analysis methods. Installation operations for loadout, frequency domain transportation, and upend can be performed with MOSES. SACS jacket, deck, or general cargo models can be imported and included in any analysis.

MOSES Advanced:

Stability, Motions, Mooring, and Structures

The MOSES Advanced package adds time domain and structural analysis capabilities to the MOSES package, which can be applied using either strip theory or 3D diffraction panel methods of calculation. When coupled with mooring line dynamics and large deflection rod elements, MOSES Advanced can be used to model risers. The structural solver allows for structural analysis of all, or part, of the system, including vessel stiffness during transportation fatigue analysis.

MOSES Enterprise:

Stability, Motions, Mooring, Structures, and Launch

The MOSES Enterprise package provides a complete range of functions, from modeling of hulls and calculation of stability, to prediction of motions, mooring analysis and structural analysis, plus launch analysis, completing the range of installation operations capabilities. Inclusion of generalized degrees of freedom enables studies of new or existing FPSOs and platforms as well as transportation and installation analysis.

Productivity Tools:

MOSES Solver

All three packages 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

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

mooring lines, tension- and compression-only nonlinear springs, rigid connectors such as pins and launchways, and even true nonlinear rod elements.

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, including reporting
- Database capability with restart options
- Macros, loops, and conditional execution

MOSES Editors

All MOSES packages include the MOSES smart language editor for managing scripts and data files, Hull Modeler for 3D interactive creation of hull shapes, Stability Modeler for compartmentation and load case management, Motions Modeler for environmental and mooring inputs, and Hull Mesher for graphical creation of structural models.

Capabilities:

Basic Connectors

The Basic Connectors module provides a generalized way of modeling lifting slings, anchor lines, mooring lines, nonlinear 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 with tension or compression only
- Gaps, pins, and lines provide constraints to motion

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.

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

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.

- Hull Modeler automatically generates hydrodynamic meshes
- 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
- 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, nonlinear and frequency domain analysis
- Modal analysis using subspace iteration
- Code checking to API, AISC, NORSOK, and ISO
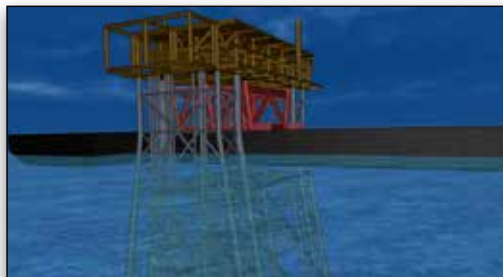
Jacket Launch

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
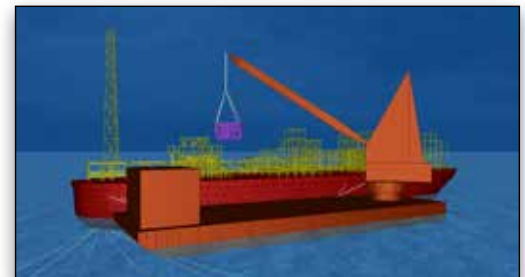- Optional side launch

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.

MOSES-SACS Intraoperability

MOSES imports SACS structural models for offshore installation analysis. Generating SACS TOW files from MOSES allows automatic generation of inertial based acceleration loading and RAOs.

Tool/Capability	Packages		
	MOSES	MOSES Advanced	MOSES Enterprise
MOSES Editor	3	3	3
Hull Modeler	3	3	3
Stability Modeler	3	3	3
Motions Modeler	3	3	3
Hull Mesher	3	3	3
MOSES Solver	3	3	3
MOSES Language	3	3	3
Strip Theory	3	3	3
Basic Connectors	3	3	3
3D Diffraction	3	3	3
Time Domain		3	3
Pipe & Rod		3	3
Structural Solver		3	3
Jacket Launch			3
Generalized D.O.F.			3

Installation Analysis

Multi-body Lifting Simulation

Bentley
Advancing Infrastructure