Sesam Floating Structures

From hydrostatics to fatigue analysis

DNV Software

MANAGING RISK

Safety at Sea

50 years of experience in developing quality software has led to the most flexible solution for integrating engineering tasks, applications, and information

Key challenges

The demand for faster design of offshore structures has increased during the last decade with many operators wanting to fast-track field installations. At the same time the worldwide yard capacity is under strain and there is lack of engineering resources.

When designing offshore structures all the life cycle stages need to be considered. Traditionally this has involved a broad variety of computer aided engineering tools and associated data models. As a consequence, valuable time is lost in the making of several data models of the same structure, and in learning to use more than one software tool.

The lack of data integration between the various software tools prevents efficient design iterations, as it is necessary to modify the various data models and perform re-analysis for each project revision. Furthermore, when different models are created the design project is prone to quality problems – in particular when the project set-up is based on a globally distributed working environment.

Our innovation

The Sesam Floating Structures is a complete toolkit to do hydrostatic, hydrodynamic and structural strength analysis. This leads to enhanced quality, reduced software costs and reduced need for training.

Using concept technologies in computer-aided engineering has proven to be cost-efficient in all the life cycle phases, since the same concept model can be used for different complexities. Typically, the same concept model can be used to create different analysis representations for hydrostatic/dynamic analysis, global strength analysis, local ULS analysis and detailed fatigue analysis. The use of concept modelling enables Sesam to do fast design iterations.

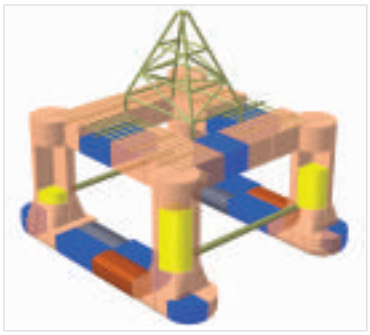
By modelling your experiences – or best engineering practices – in a workflow modelling system, it is possible to share these as templates to the entire organisation. This leads to standardisation of work processes, reduced learning curve and the facilitation of distributed work, resulting in increased quality.

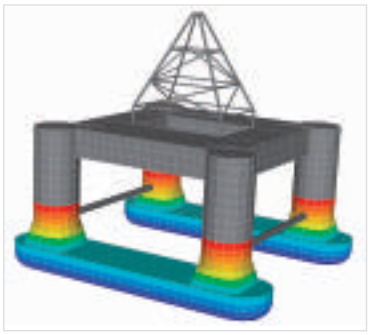
The Sesam Floating Structures covers all aspects needed to document a safe design – from modelling, through analysis to results assessments and the process itself for the entire life-cycle.

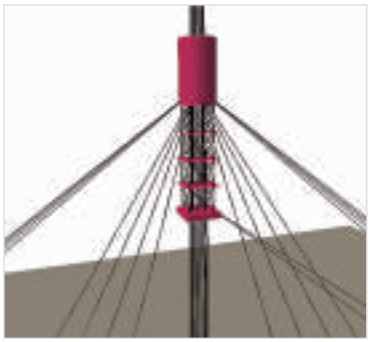
- Conceptual design and FEED analysis
- Detailed design and verification
- Fabrication and installation
- Operation and maintenance
- Abandonment and removal

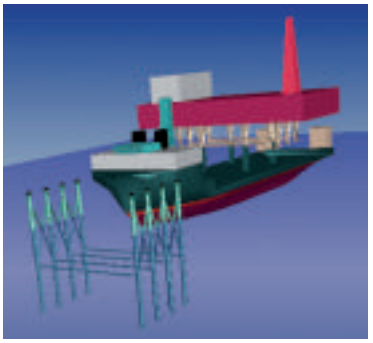
Field development

Ballasting, hydrostatic and sea-keeping analysis of offshore floaters









Applications

The Sesam Floating Structures can be used for ballasting, hydrostatic and hydrodynamic analysis of large floating structures like barges, ships of any type, semi-submersibles, tension leg platforms, floating production storage units or spar buoys. Design of mooring lines and risers ranging from shallow to ultra-deep water depths are also supported.

Documenting stability criteria

The package provides the necessary functionality to compute the key decision results for longitudinal strength and stability data. The stability computations may be run for both intact and damaged condition including flooded compartments and varying wind heeling moments supporting the requirements by IMO MODU and NMD.

Some of the key results provided are

- Stability curves including the effects from openings and free surface of compartments
- Righting and heeling moments
- Still water longitudinal forces and moments
- Allowable centre of gravity
- Analysis results checked against rules defined by internationally recognised codes like NMD and IMO MODU

Wave loads

Traditionally, the linear 3D radiation-diffraction theory in the frequency domain combined with the Morison equation have been used to efficiently perform sea-keeping analysis with the purpose to predict motion characteristics and the hydrodynamic pressures acting on the floater. It is also possible to perform a more precise analysis in time domain when non-linear effects must be considered. For both options statistical post-processing can be performed and pressures and accelerations are transferred to a subsequent structural analysis.

Mooring and riser design

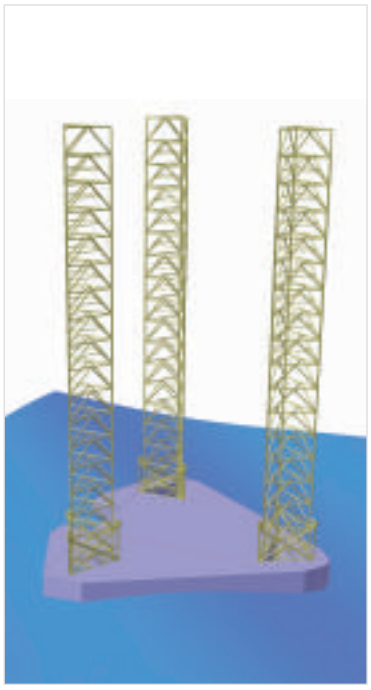
For deep-water solutions it is important to consider coupled effects when designing the moorings and risers. The coupled analysis includes the effect from having multiple floaters on complex field layouts. The design of moorings and risers may also be done using a more traditional linear approach. It is also possible to do analysis relevant for marine operations.

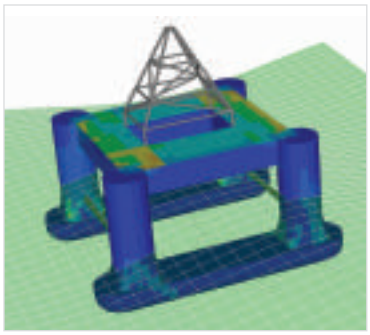
"As the oil and gas fields get deeper, the installations of deep-water platforms become more challenging. The coupling effects between a floater and it's moorings become more pronounced and more important. Sesam is an excellent tool for analysing the interaction between hull, moorings and risers."

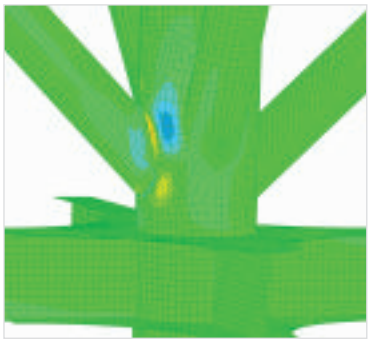
Andy Kyriakides, Project Manager, Modec International LLC.

Concept based engineering

The quickest way to document a safe design







Perform your analysis with ease
Sesam supports the life-cycle approach of offshore structures. This means that analyses may be carried out for the different stages in a platform's life. Common for all analyses is that they are easy to carry out. Either a direct approach (no integration with hydrodynamic analysis) or a fully integrated analysis is used.
There are no limitations to the analysis models in terms of model size or number of loadcases. The analyses are carried out using a highly efficient and robust solver, enabling the use of standard hardware for large problems.

Analysis types supported are typically global and local structural analysis, eigenvalue analysis, forced dynamic analysis and push-over analysis. Sesam has been known to support distributed and concurrent engineering by using the super-element technique. It is also very easy to perform local refined analysis based on a global analysis model without the need for re-analysis of the whole structure.

Closing the design loop
Results assessment is normally a major part of the design process. This package facilitates an easy way to graphically evaluate results whether they are deformations, forces, stresses or fatigue life. 3D high-resolution pictures or tables for use in design reports may be created one by one or by use of scripting techniques.

Offshore structures subjected to wave loads are normally analysed with a high number of loadcases. There are powerful features for combining results and to find the worst conditions.

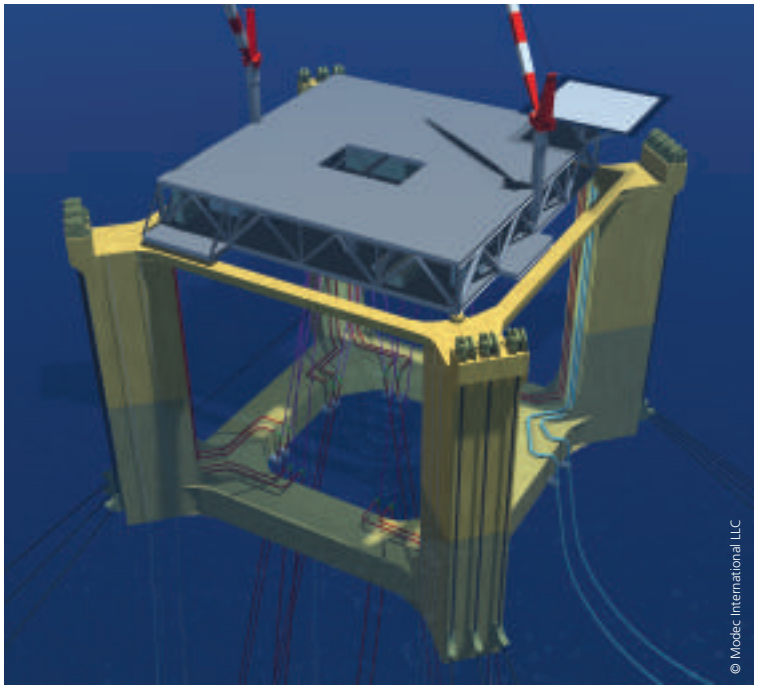
The design of an offshore structure is normally governed by satisfying international recognised regulations or fatigue life. Typically for framed topsides the code checking is performed according to API/LRFD, ISO and Norsok/Eurocode. For plated structures the supported standards are API, DNV RP-C201.1 and DNV RPC201.2 (Puls).

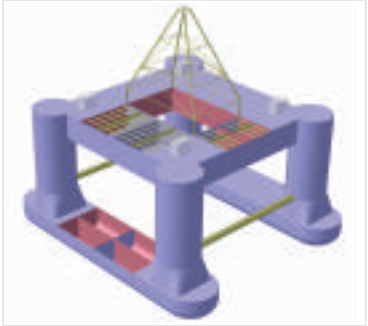
The fatigue life analysis of beams may be carried out using a deterministic or stochastic approach – for plates a stochastic approach is possible including fatigue screening as well as refined local fatigue analysis.

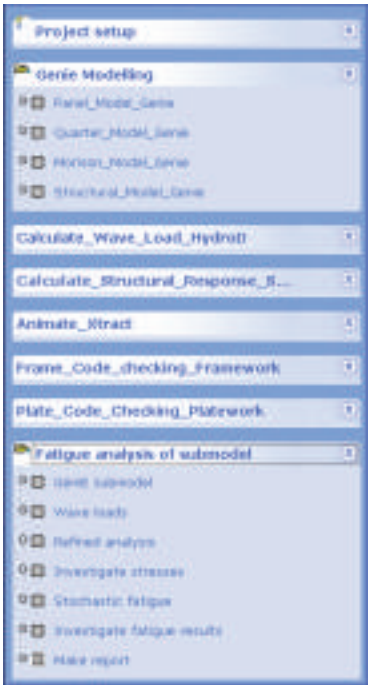
Best engineering practices
Sharing data and knowledge is important in a dynamic engineering environment. By using the workflow modelling tool Brix Explorer – configured for Sesam – you may model all your processes related to Sesam work. The workflows can also be enhanced by including checklists and other guiding documents.

Integrated analysis

Best engineering practice integrated with predefined workflows covering the life cycle aspects of the installation







The workflows may be saved as templates for your organisation and made available to all your engineers. This way you ensure a common way of working and gain a shorter learning curve for new engineers. In other words, it's an excellent starting point for learning and will improve the way you organise your engineering work.
The Floating Package contains pre-defined templates to guide users to work efficiently with Sesam as well as to learn how to make their own templates.

Packages
There are three main packages to select from. In addition, you may configure the packages based on level of needed functionality. The packages build on each other – i.e. the functionality in one package may be used in the next package

The topside package
This package focuses on the engineering of topside structures built up of beams and plates where the loads are manually applied – typically acceleration or other explicit loads. It is possible to do linear as well as push-over analysis. The strength assessments are typically displacement and stress evaluations as well as code-checking of beams and plates.

The hull package
Together with the topside package, this solution enables engineers to do hydrostatic, hydrodynamic and structural strength assessments. The wave loads are automatically used in the strength analysis, and these form the basis for fatigue analysis of the topside or the hull part. The hull package comes in two variants – one for hydrostatic and hydrodynamics while the other includes structural strength analysis.

The mooring and riser package
Riser and coupled analysis as well as marine operations are performed in this package. Relevant hydrodynamic attributes computed by the hull package is automatically used by the mooring and riser package.

Please contact us for more technical information or visit our product pages on the Internet.

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