



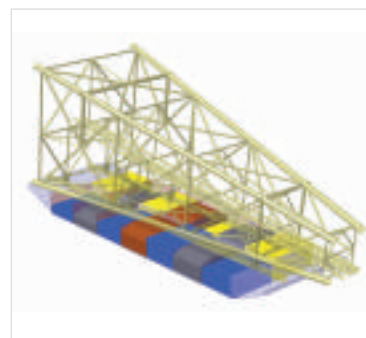
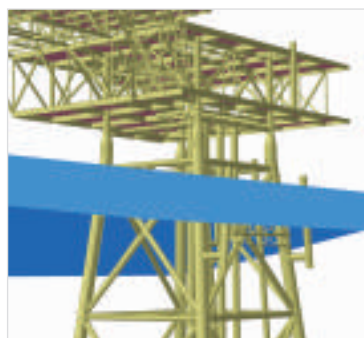
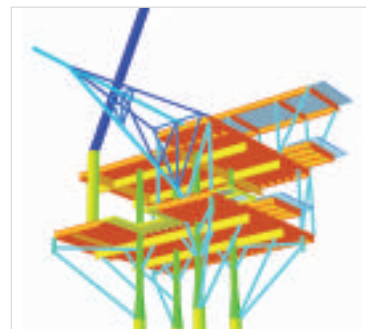
Sesam Fixed Structures

From conceptual engineering to decommissioning

DNV Software

Confidence in fixed structures

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. Yet worldwide yard capacity is strained and there is a lack of engineering resources in a globally distributed working environment.

When designing offshore structures, all life-cycle stages need to be considered. Traditionally this has involved a broad variety of computer-aided engineering tools and associated data models. Valuable time is lost by making several data models of the same structure, and in learning different software tools. Furthermore, the lack of data integration between software tools prevents efficient design iterations, as it is necessary to modify the various data models and perform re-analysis for each project revision.

Our innovation

The Sesam Fixed Structures is a complete toolkit to do hydrodynamic, pile/soil and structural strength analysis covering the stages in a structure's lifetime. This leads to enhanced quality, reduced software costs and reduced need for training.

Concept technologies in computer-aided engineering have proven to be cost-efficient in all life-cycle phases, since one unique concept model can be used with differ-

ent complexities to create different analysis representations. This facilitates an efficient way of assessing the structure in different stages by analysing various parts of the structure with different boundary conditions – all from the same model. Another major benefit is that concept technologies lead to faster design iterations.

By modelling your experiences 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 increased quality.

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

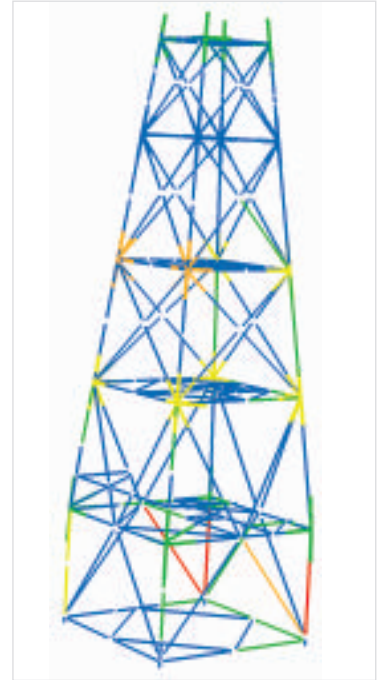
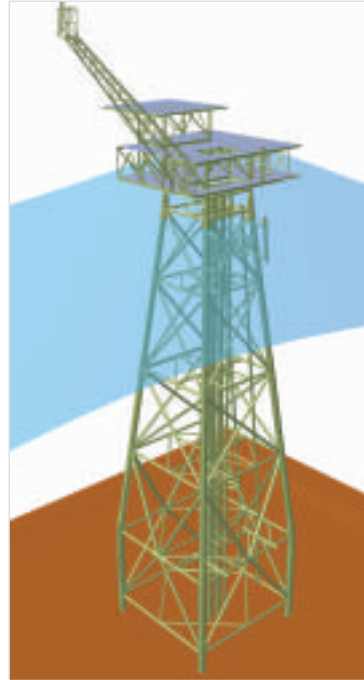
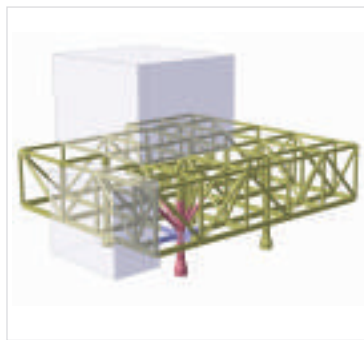
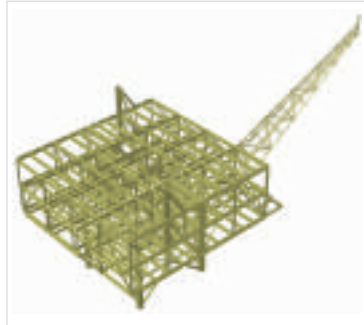
- Conceptual design and FEED analysis
- Detailed design and verification
- Fabrication and installation
- Operation, maintenance and life-time extensions
- Decommissioning

Applications

The Sesam Fixed Structures can be used for linear and non-linear analysis of fixed slender structures like jackets, jack-ups, topsides, bridges, flare booms and other structural parts. The analysis types range from launching and upending, non-linear pile/soil analysis, structural strength & hydrodynamic analysis, collapse analysis,

Field development

Grow conceptual studies to detail design



fatigue and other accidental analysis. Typical transport analysis can also be performed.

Modelling the environment

The package provides the necessary functionality to model and compute the effect of wave, current and wind. These are calculated according to Morison's equation (optionally MacCamy Fuchs) and are automatically used by structural analysis or statistical post-processing.

There are three different approaches for load calculations

- Deterministic load calculation in time domain
- Calculation of force transfer in the frequency domain
- Time domain simulation of wave loads for a given short term seastate

The wave loads may be computed according to a number of theories (Airy, Stoke 5th, Dean stream function, Cnoidal and Newwave) including current. The wind effects can be included in the deterministic analysis or computed separately. It is also possible to compute wind gust effects for use in fatigue analysis. There are several hydrodynamic parameters that can be varied – typically C_d , C_m , marine growth, blockage factors and so on. The soil may be represented with multiple layers and soil types in between. The soil types may be of sand or clay and can all have different values for PY, TZ and QZ

curves (the standard curves are built into the system). Several additional soil characteristics may be represented.

Modelling the structure

A slender structure is normally modelled using beam members but plates or shells may also be used – either as an integrated part of the global model or as an independent model. Typical examples may be for joints to determine stress concentration factors for use in fatigue analysis.

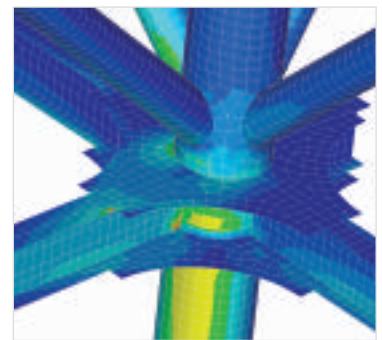
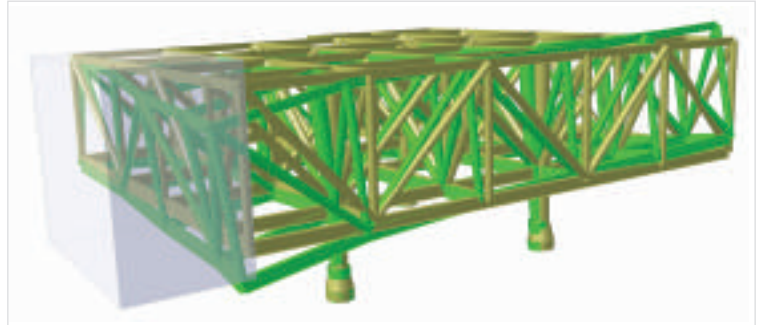
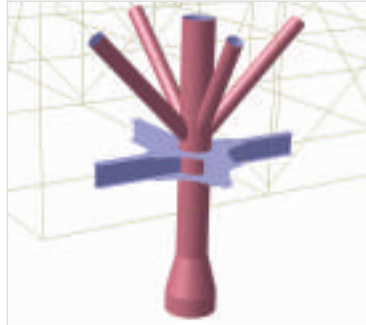
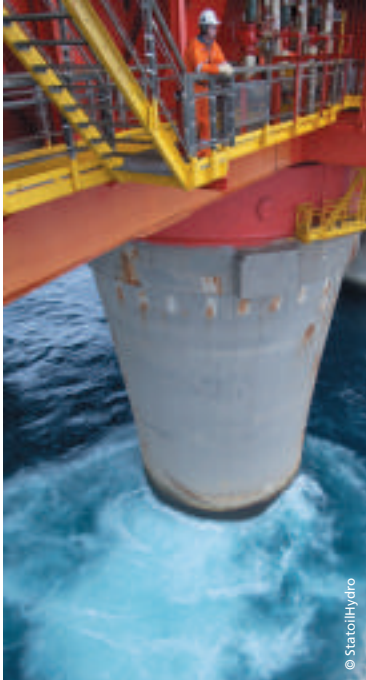
Structural elements range from straight beam members, overlapping beams, pile elements, truss elements and shim elements. Members can also be denoted as non-structural and for advanced analysis the beams may also be curved. The profile and material libraries reduce the amount of input.

Tubular joints may be made automatically with cans, stubs, cones and plane-wise gaps according to recognised standards or user defined rules. Stiffened decks can be made with automatic flushing of the stiffeners.

Piles are easily created by defining a start and stop position independent of soil layers and connection to the jacket structure. When creating analysis models, the necessary points interacting with the soil are automatically defined.

Concept based engineering

The quickest way to document a safe design



Modelling the masses and loads

The structural mass is automatically calculated based on the density of the materials used; this mass may be scaled to a target level. The hydrodynamic added mass is automatically accounted for. It is also possible to add extra masses by using explicit point masses or the mass from equipments.

The masses may be used to generate loads in a static analysis typically by defining acceleration fields (constant or centripetal). For eigen-value and dynamic analyses the masses are used “as is”.

Equipments generate line loads on beams based on the footprints and accelerations. Any footprint configuration can be represented and horizontal accelerations will set up force pairs in addition to the shear force. It is also possible to classify which beams to receive loads from equipments, typically primary and secondary beams. Explicit loads like point loads, line loads, surface loads, temperature loads and prescribed displacements can be specified.

“Keppel chose Sesam software for its user-friendliness and technical reliability as well as cost-effectiveness.”

Paul Liang, Section Manager, Engineering Division Keppel O&M

Perform your analysis with ease

Sesam supports the life-cycle approach of offshore structures and analyses may be carried out for the different stages with or without integration with hydrodynamic analysis.

There are no limitations to the analysis models in terms of model size or number of loadcases. A highly efficient and robust solver enables the use of standard hardware for large problems.

Analysis types supported are typically global and local structural analysis, eigen-value analysis, forced dynamic analysis and push-over analysis. For jackets and jack-ups a global analysis often involves a non-linear pile/soil analysis and/or wave load analysis.

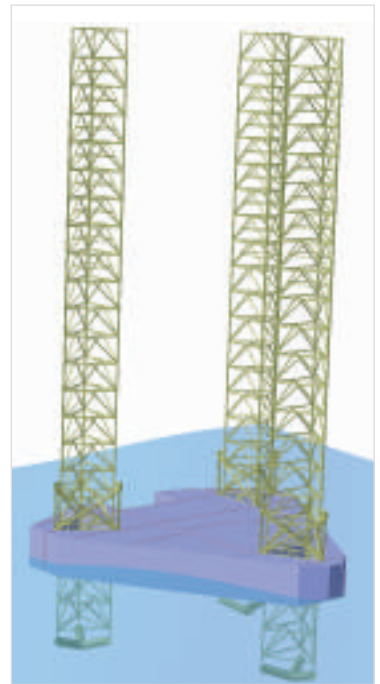
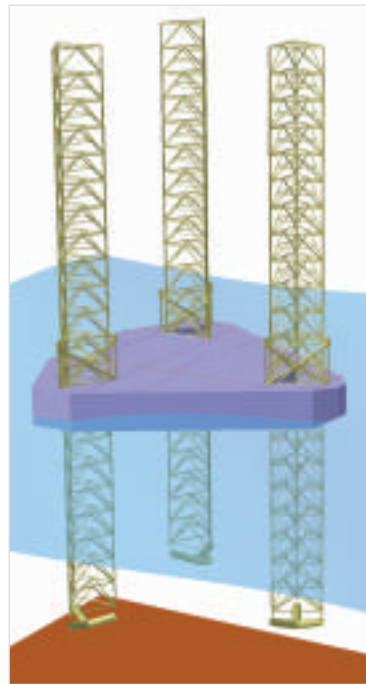
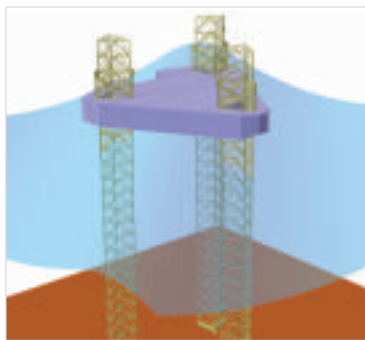
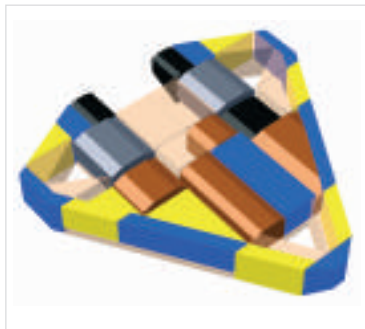
Local analysis may be carried out by refining the area of interest in the global model or by using sub-modelling techniques without the need for re-analysis of the whole structure.

Closing the design loop

This package facilitates an easy way to graphically evaluate results whether they are deformations, forces, stresses or fatigue life. 3D high-resolution pictures, 2D graphs or tables for use in design reports may be created one by one or by use of scripting. There are powerful features

Integrated analysis

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



for combining results over many loadcases and for finding the worst conditions (scanning or envelopes).

The design of an offshore structure is normally governed by satisfying international recognised regulations or fatigue life. Typically for framed structures the code checking (member and geometry checks as well as tubular joint checks) is performed according to ISO, API/WSD&LRFD, AISC, Norsok and Eurocode. The code check results may be presented graphically or in reports. For plated structures the supported standards are API, DNV RP-C201.1 and DNV RPC201.2 (Puls).

The fatigue life analysis of beams uses 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 is important in a dynamic engineering environment. By using the workflow modelling tool Brix Explorer you may model all your processes related to Sesam work. The workflows can also be enhanced by including your own checklists or other guiding documents.

The fixed package contains pre-defined templates to guide users to work efficiently with Sesam and to make their own templates.

Packages

There are two main packages to select from; the topside and jacket package. You may configure the packages based on the necessary level of functionality.

The topside package focuses on the engineering of topside structures built up of beams and plates where the loads are manually applied – like 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.

Together with the topside package, the jacket package enables engineers to do pile/soil, 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, flare-boom or the supporting structure.

The main programme module used in the Sesam Fixed Structure is GeniE. It is supported by functionality for wave loads, pile/soil, analysis, fatigue, launching and upending and progressive collapse.

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