PRODUCT DATA SHEET

Bentley
Advancing Infrastructure

CONNECT Edition

Bentley SACS

Offshore Wind Turbine Analysis

SACS software provides a comprehensive set of capabilities for the design and analysis of offshore wind turbine structures subject to wave, wind, and mechanical loading. The analysis approach is capable of predicting both fatigue and extreme loads for the substructure and non-linear foundation.

The CONNECT Edition

The SELECT® CONNECT Edition includes SELECT CONNECT *services*, new Azure-based services that provide comprehensive ***learning, mobility,*** and ***collaboration*** benefits to every Bentley application subscriber. *Adaptive Learning Services* helps users master use of Bentley applications through CONNECT Advisor, a new in-application service that provides contextual and personalized learning. *Personal Mobility Services* provides unlimited access to Bentley apps, ensuring users have access to the right project information when and where they need it. *ProjectWise® Connection Services* allow users to securely share application and project information, to manage and resolve issues, and to create, send, and receive transmittals, submittals, and RFIs.

Wave Loading Analysis

The wave loading can be represented by either a time history or in spectral form. A random wave surface profile may be determined from a wave height spectral density function using multiple random seeds. The following wave spectra are available:

- Pierson-Moskowitz
- JONSWAP
- Ochi-Hubble
- User-defined

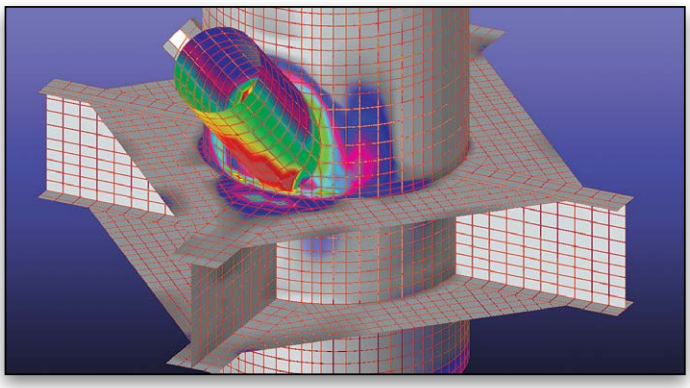
Wind Loading Analysis

Similarly, the wind loading can be input as time history or as a random loading developed from the following available spectra:

- Von-Karman
- Harris
- Kaimal
- User-defined

Fully Coupled or Uncoupled Analysis

The software features an interface to the GH Bladed and FAST* software, accounting for the full coupling between wave, wind, and the wind-induced mechanical loading for a multi-modal response analysis. The GH Bladed multi-core interface is fully automated, allowing the user to handle hundreds of time history simulations required for a typical fatigue analysis. The optional multi-core capabilities allow for a dramatic reduction in runtime.



Color-coded stress contours

Equivalent static loads—representing both inertia loading and hydrodynamic/aerodynamic loading—may be created as part of the analysis at time points selected automatically by the program.

Alternatively, the wind-induced mechanical force time history can be assumed to be independent of the wave and wind loads for an uncoupled analysis.

For a random analysis, equivalent static loads—representing both inertia loading and hydrodynamic/aerodynamic loading—may be created as part of the analysis at time points selected automatically by the program, user-specified times, or time increments.

Dynamic Superelement

SACS applications include a Dynamic Superelement module based upon the Craig Bampton approach. The dynamic superelement is completely compliant with Siemens BHawC aeroelastic code.

Fatigue Analysis

The SACS fatigue analysis method uses the Rainflow counting approach to predict the stress cycles resulting from a time history analysis—including the ability to sequentially accumulate the damage from multiple analysis simulations for numerous wind speeds and sea-states.

*FAST: "Fatigue, Aerodynamic, Structure & Turbulence" is a National Renewable Energy Laboratory (NREL) software code available at www.nrel.gov.

System Requirements

Processor:
Core2 or better CPU

Operating System:
Windows 7, Windows 8

RAM:
Minimum 2 GB of RAM

Hard Disk:
Minimum 10 GB of free hard disk space

Display:
Graphics card supporting Open GL

128 MB RAM or greater video card with 1280x1024 or higher video resolution

Find out about Bentley at: www.Bentley.com/SACS

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Offshore Wind Turbine Analysis At-A-Glance

Offshore Enterprise:

Professional Static Offshore Package

- Contains capabilities for offshore jackets, wharfs, and dolphin structures
- Includes interactive graphics modeled with advanced 3D capabilities, SACS IV solver and interactive graphics post processor, Seastate, Joint Can, Pile, Combine, Gap, Tow, and LDF large deflection
- Features automatic model generation, beam and finite element capability, steel code check and redesign, environmental load generation, tubular connection check, single pile/soil interaction, inertia and moving load generation, tension/compression nonlinear elements with initial gap, load case combination, linear large deflection analysis, and full output report and plotting capabilities

Collapse:

Plastic Non-Linear Add-on

- Includes non-linear foundation, and non-linear and plastic analysis capabilities
- Plastic analysis includes pushover, ship impact, and blast non-linear analysis
- Collapse View interactive collapse results processor

PSI:

Pile-Soil Interaction

- Features the PSI non-linear soil/pile/structure interaction program module

Fatigue Enterprise:

Advanced Dynamic Fatigue Package

- Contains the modules required to perform any dynamic deterministic, time history, or spectral fatigue analysis

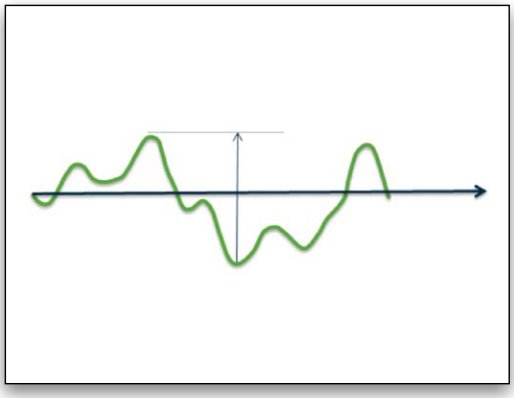
Fatigue:

Fatigue Life Evaluation and Redesign

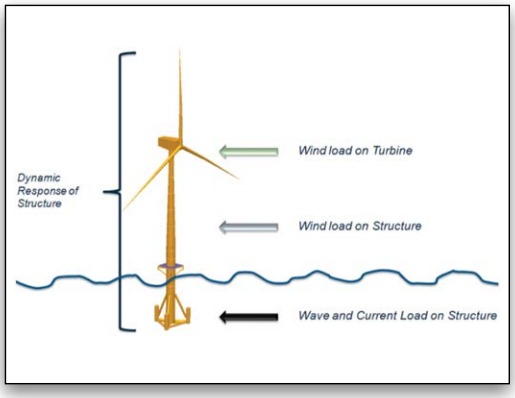
- Spectral, time history, and deterministic fatigue analysis
- Cyclic stress range calculation procedures include wave search, curve fit, and interpolation
- SCF calculations recommended by API (including 21st ed. supplements), HSE, DNV, DS449 and Norsok Codes
- Automatic redesign
- API (including 21st ed. supplements), AWS, HSE, and Norsok thickness dependent recommended S-N curves
- Multiple run damage accumulation
- Pierson-Moskowitz, JONSWAP, Ochi-Hubble double peak, simplified double peek, and user-defined spectra
- Automated or user-specified connection details
- Pile fatigue analysis
- Wave spectra creation from scatter diagram
- Paris equation used to predict crack growth rate due to cyclic stresses
- Load path dependent joint classifications
- Includes wave spreading effects
- Reservoir (rain flow) cycle counting method
- ISO 19902

Bentley Cloud Services:

- Dramatically reduce compute time for wind turbine designs by providing unlimited analytical resources using the power of the cloud. Run hundreds of load cases in parallel, reducing compute time by up to 10 times over desktop or local server. Perform comprehensive analysis of all necessary load conditions in a fraction of the time.



Rainflow counting approach to predict the stress cycles resulting from a time history analysis.



Wind turbine fatigue analysis-loading on structure.

SACS®

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