Bentley®
Advancing Infrastructure

CONNECT Edition

OpenWindPower™ Fixed Foundation
Offshore Wind Turbine Analysis

OpenWindPower Fixed Foundation software provides a comprehensive set of capabilities for the design and analysis of offshore wind turbine foundation structures subject to wave, wind, and turbine mechanical loading. The analysis approach is capable of predicting both fatigue and extreme loads for the substructure and nonlinear soil foundation.

Wave and Wind Loading Analysis
Wave and wind loading can be represented by either a time history or in spectral form. Commonly used wave and wind loading spectra are available.

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 multimodal response analysis. The GH Bladed multicore interface is fully automated, allowing the user to handle hundreds of time history simulations required for a typical fatigue analysis. The optional multicore capabilities allow for a dramatic reduction in runtime.

Joint Mesher
The Joint Mesher program allows for the seamless creation of 3D meshes for complex stiffened and unstiffened joints in minutes, saving many hours of detailed mesh generation. Joint Mesher also automates the creation of extraction nodes for hot spot SCF calculation in accordance to DNVGL RP-C203 or a user-defined setting. The program then creates the mesh and the corresponding predefined loading conditions (axial and in- and out-of-plane bending) for the static analysis and post processing for automatic SCF extraction.

OpenWindPower Job Creator
The analysis and design of an offshore wind turbine substructure and foundation involves the analysis of tens of thousands of time history simulations with different wind, wave, and turbine loadings. The Job Creator allows the user to use an Excel spreadsheet to automatically set up the file/directory structure for all the time history simulations in minutes, saving weeks of manual, error-prone job creation.

Large Diameter Monopiles
The API approach severely underestimates the load carrying capacity of large diameter monopiles. The OpenWindPower – PLAXIS Monopile Designer
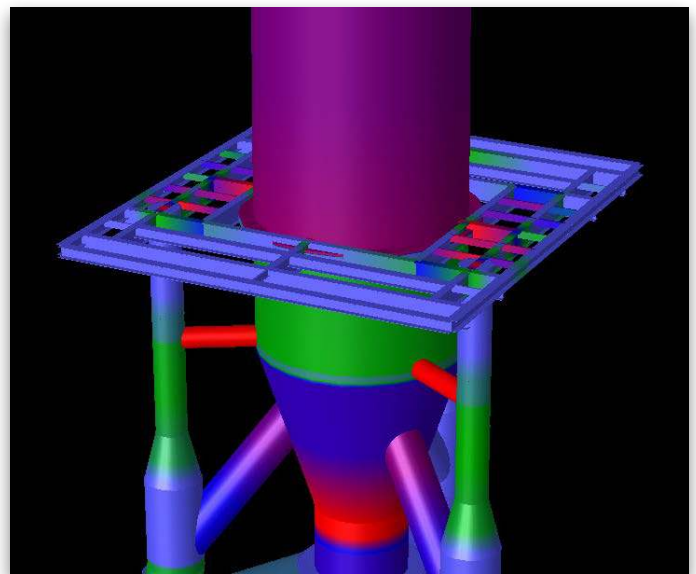
Color-coded stress contours

interface to the finite element based SACS Pile3D module allows the user to determine the load carrying capacity of large diameter monopiles in accordance with the PISA2 method resulting in a cost savings up to 30%.

Suction Bucket Foundation Design
The OpenWindPower – PLAXIS interface allows the user to design single or multiple suction buckets seamlessly with the accurate soil structure interaction and capacity checks in PLAXIS 3D to the full bucket structural analysis and code design in SACS. The approach accounts for the full nonlinear interaction between multiple suction bucket foundations on a substructure.

OpenWindPower-Siemens Femap Interface
The Femap interface allows the user to model transition or component pieces and other complex geometries in Femap and import them into SACS for analysis and design.

Cloud or LAN Grid Computing
The Cloud or LAN Grid option allows the user to define multiple virtual or physical computer nodes over a cloud or company's local area network to run multiple analysis in parallel, to achieve up to 100 times saving in analysis computing time.

OpenWindPower Fixed Foundation At-A-Glance

Ultimate Static Offshore Package

- Contains capabilities for offshore jackets, wharfs, and dolphin structures

- Includes interactive graphics modeled with advanced 3D capabilities 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

Plastic Nonlinear Collapse Advanced

- Includes nonlinear foundation, and nonlinear and plastic analysis capabilities

- Plastic analysis includes pushover, ship impact, and blast nonlinear analysis

- Collapse results viewer with graphical step navigation along the loading-time chart

Pile-soil Interaction

- Features the PSI nonlinear soil/pile/structure interaction program module. Includes interface to PLAXIS Monopile Designer for large diameter monopile analysis in accordance with the PISA2 approach

Advanced Dynamic Fatigue Package

- Contains the modules required to perform any dynamic deterministic, time history, or spectral fatigue analysis
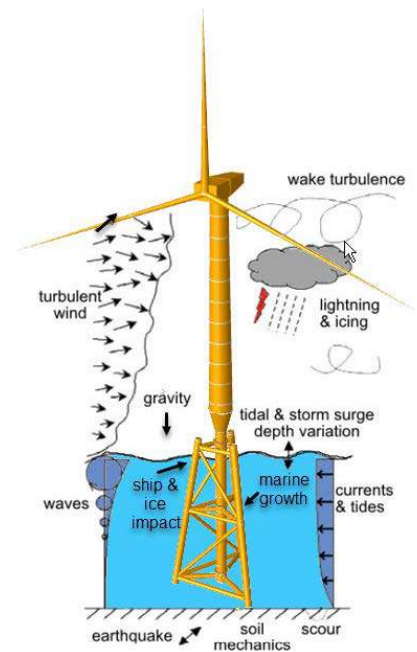
Fatigue Life Evaluation and Redesign

- 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

Turbine Manufacturer Interfaces

- Siemens, MHI Vestas via Craig Bampton dynamic superelement
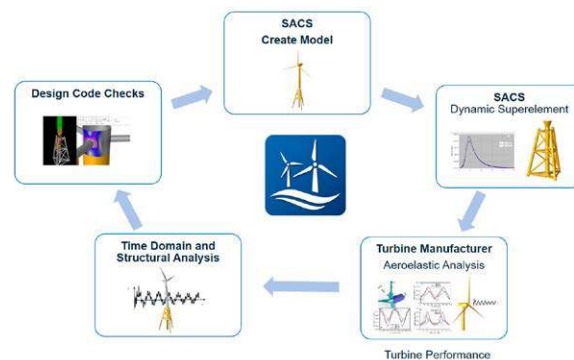
OpenWindPower Fixed Foundation Workflow

Turbine Loading

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