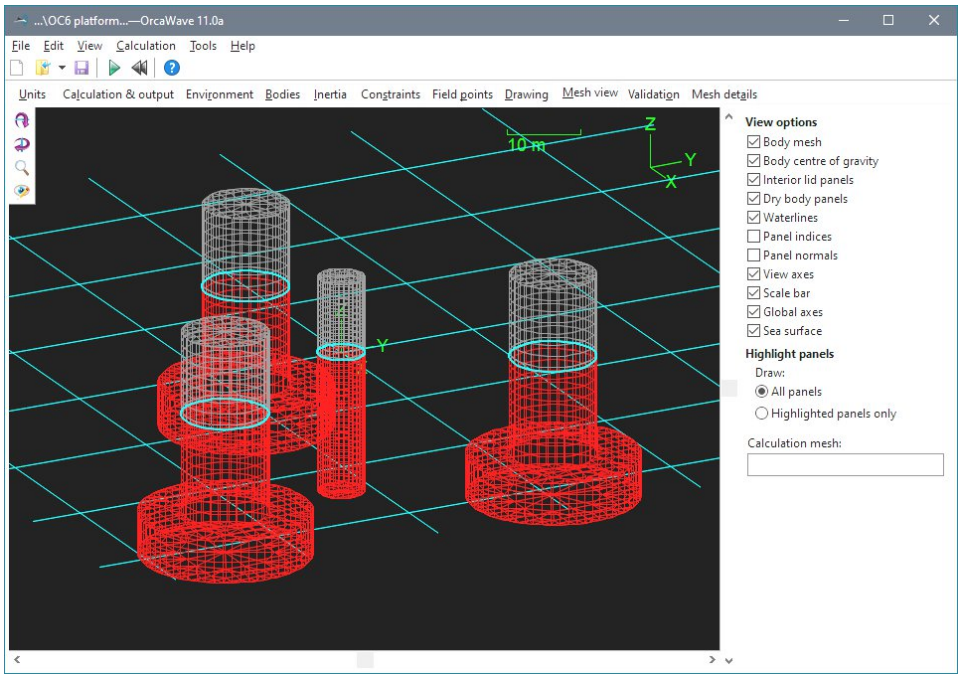
orcaflex newsletter



Contents

In this Newsletter

OrcaFlex 11.0 was released towards the end of 2019 and was distributed to all customers with up–to–date MUS contracts.

This newsletter reviews some of the new features in 11.0, and also those that we hope to introduce in 11.1 towards the end of 2020.

Diffraction

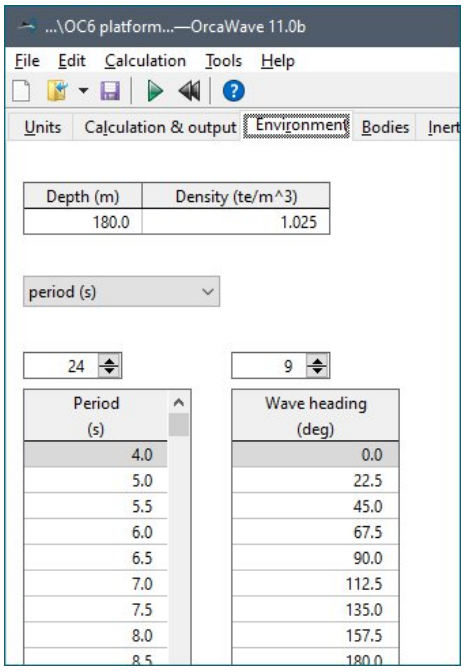
OrcaWave is here!

In the 2019 newsletter we previewed the early progress we were making on the development of a diffraction code. We are pleased to say that this has been released as part of OrcaFlex 11.0. **OrcaWave** is licensed as part of OrcaFlex, but runs as a separate executable.

OrcaWave capabilities:

- First & second order calculations
- Single & multibody analyses
- Sea state RAOs
- Seamless transfer of data from OrcaWave into OrcaFlex.

The user interface is very simple in comparison to OrcaFlex. Data and results are spread across a number of pages, but all in a single window.



OrcaWave user interface

After a diffraction analysis has been run, the resultant OrcaWave results file can be imported directly into an OrcaFlex vessel type with minimal effort.

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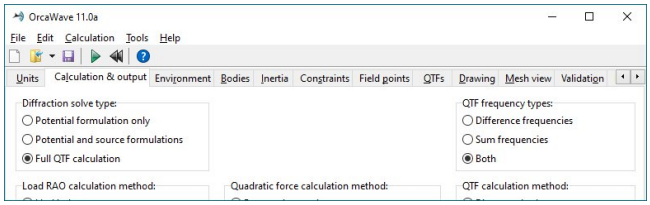
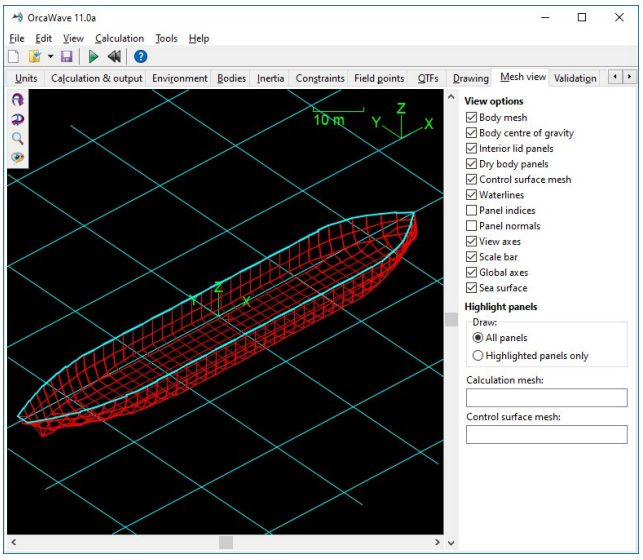
A look at the user interface

The data for an OrcaWave analysis is entered and reviewed using a number of pages. Some of these, such as the units and drawing pages, will be very recognisable to OrcaFlex users, others less so. Having said that, even the 'new' pages will be somewhat familiar, since the look and feel is very similar to OrcaFlex.



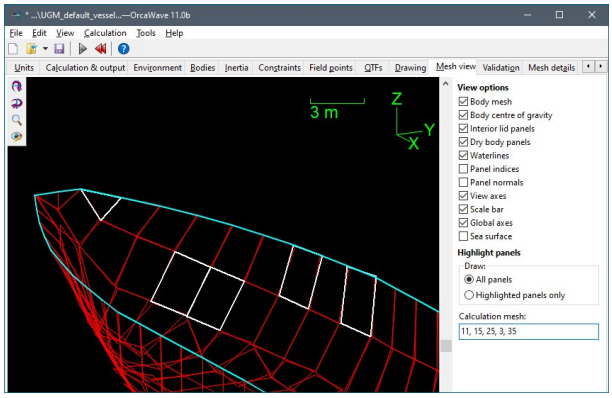
OrcaWave data input & data review pages

We have made no attempt to implement any meshing functionality in OrcaWave. Instead we rely on users providing panel meshes. Perhaps at some point in the future we may add meshing, but it is currently not high on our priority list. At Orcina we have used, for example, Rhino to produce meshes and no doubt users are familiar with plenty of other meshing tools. OrcaWave can accept meshes in Wamit .gdf, Nemoh .dat, and Hydrostar .hst format, but we expect the list of supported formats to grow in future releases.



OrcaWave mesh view

We have thought hard about the mesh visualisation functionality. The quality of diffraction analysis frequently hinges on the quality of the provided mesh. Being able to visualise that mesh aids hugely in diagnosing problems with your analysis. The view options allow you to select exactly what is displayed. The highlight option allows you to identify specific panels from the mesh, and works very smoothly with the mesh validation feature of OrcaWave.

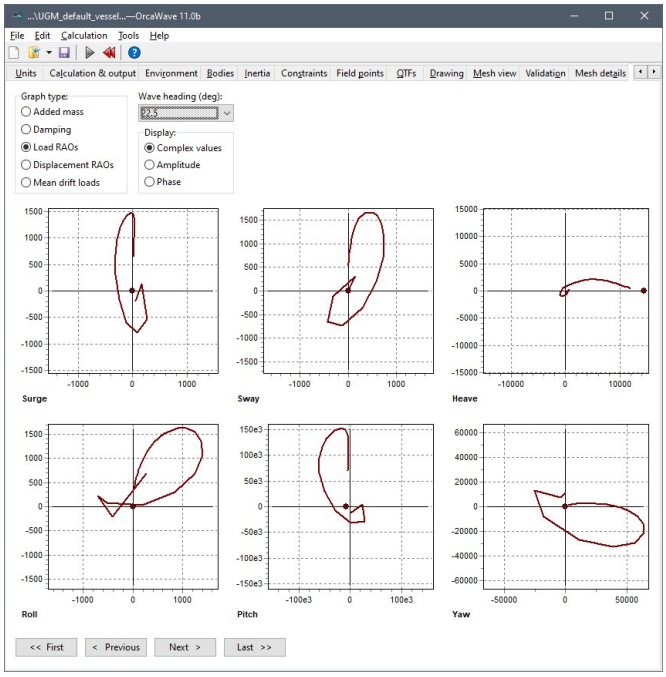


Mesh view showing highlighted panels

There is a batch processing window similar to that of OrcaFlex. The output can be viewed graphically (for RAOs, added mass and damping), and is available in tabular form. These tables can be saved as Excel workbooks. The OrcaFlex API has been extended to include diffraction, so all the functionality is now available from Python or MATLAB.

What about results?

Results from the analysis are available in both graphical and tabular form. OrcaFlex is able to import hydrodynamic data from OrcaWave analyses, and because the two programs are designed to work together there is none of the uncertainty over conventions that can sometimes arise when importing hydrodynamic data.



OrcaWave results graphs page

Help!

As with OrcaFlex, you can find full details of OrcaWave's capabilities in the documentation, available contextually via F1, or from our website.

Validation

We have validated OrcaWave by comparing its output to that of Wamit, for cases covering the entire range of functionality of OrcaWave. This validation exercise will be turned into a published document over the next few months.

What's next for diffraction?

There is some desirable functionality that we didn't have time to implement in this first release of OrcaWave. One of the biggest improvements we intend to make in the next development cycle is to add the option of using iterative solvers as an alternative to the current direct matrix solvers. We are aware that, for large meshes, performance can be greatly improved in this way. We are sure that users will have many other feature requests, and we look forward to receiving such feedback and prioritising future developments.

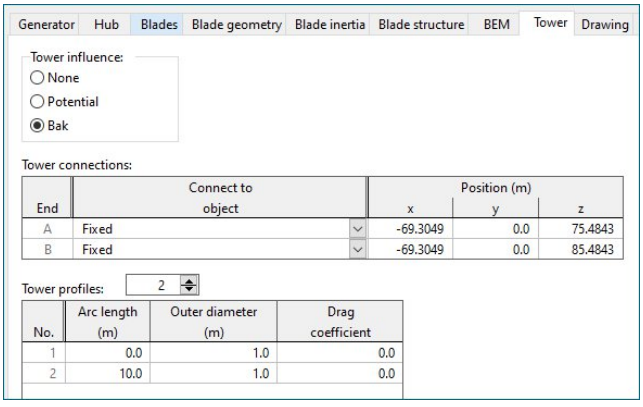
Turbine enhancements

Last year we introduced the OrcaFlex wind turbine object, designed for modelling horizontal axis wind turbines, and allowing for the first time a fully coupled floating wind turbine analysis without the need for interfacing with FAST.

We have made a number of enhancements to the turbine object:

Tower influence modelling

The wind field experienced by the rotor can be influenced by the tower that is downwind of it, the so–called tower dam effect. The turbine can now be associated with a tower by choosing from two tower influence models.



Tower influence options

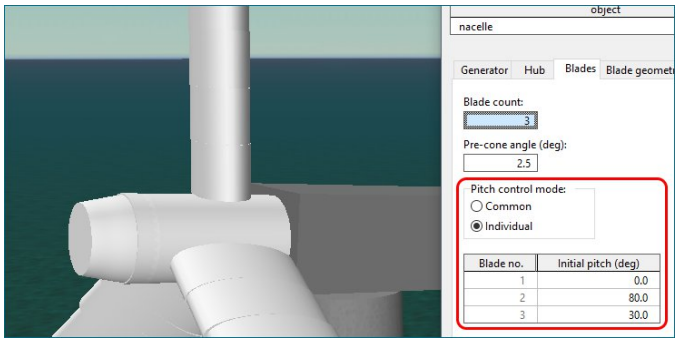
Based on potential theory, these models allow the tower's influence on the undisturbed wind field to be accounted for.

Dynamic inflow

The Øye dynamic inflow model is now available as an option when calculating the rotor aerodynamic loading. This accounts for the time that the turbine's wake takes to adjust to a change of flow conditions.

Individual blade pitch control

This is a feature that was requested by a number of users after the introduction of the turbine object in version 10.3.



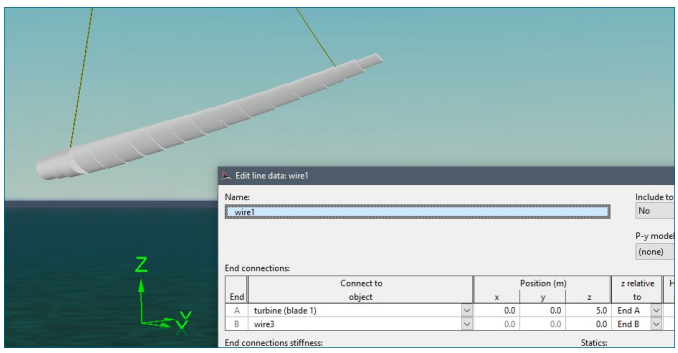
Blade individual pitch control

Blade pitch angle can now be controlled for individual blades. There is a new data item on the turbine data form called pitch control mode. If **common** is selected, then all blades share the same pitch angle, as was the behaviour in previous versions. If **individual** is selected then each blade has an independent pitch value.

Slave connections

In version 10.3, slave objects were always connected to the turbine hub. They can now be connected to an individual blade at any arc length. Why might you want to do this? The following are potential cases that may benefit:

- Simulating rotor mass imbalance from things like ice build–up or manufacturing defects.
- As a means of applying externally calculated loads.
- Modelling installation scenarios.



Turbine blade slave connections

Rayleigh damping

The finite element modelling approach for turbine blades is very similar to that of lines, and you can now specify Rayleigh damping coefficients for the turbine blade using the same model and data specification.

Convergence monitoring start time

When the BEM calculation is being performed, convergence problems are more likely at the beginning of a simulation. This is because the rotor speed is low and the wind velocity is typically being ramped up from zero. As with the build-up of waves in OrcaFlex, this phase can be regarded as transient and is often not of interest. Any BEM warnings generated in this period can therefore be misleading.

It is now possible to suppress reporting of any BEM convergence warnings that arise before this time.

New results

The following new results are now available for turbines:

- blade deflections
- tower and line clearances
- rotor aerodynamic load and power
- rotor aerodynamic thrust and power coefficients
- rotor swept area
- skew angle
- disc averaged wind velocity
- extra BEM output

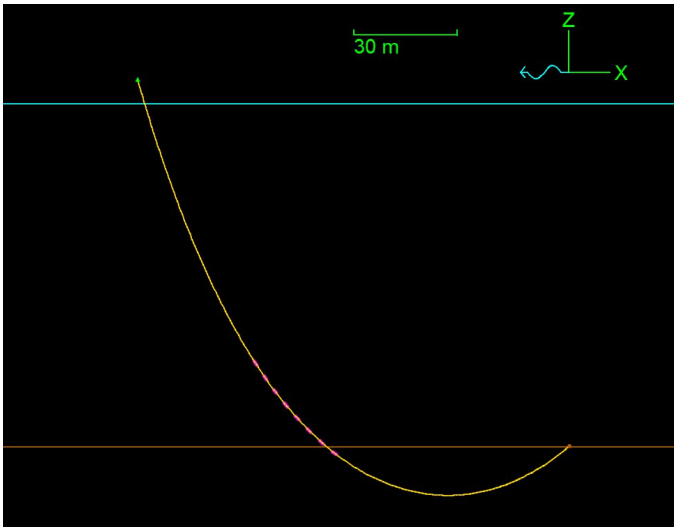
Line enhancements

Lines have always been one of the most fundamental of OrcaFlex building blocks, and we have introduced a number of improvements to this object for v11.0.

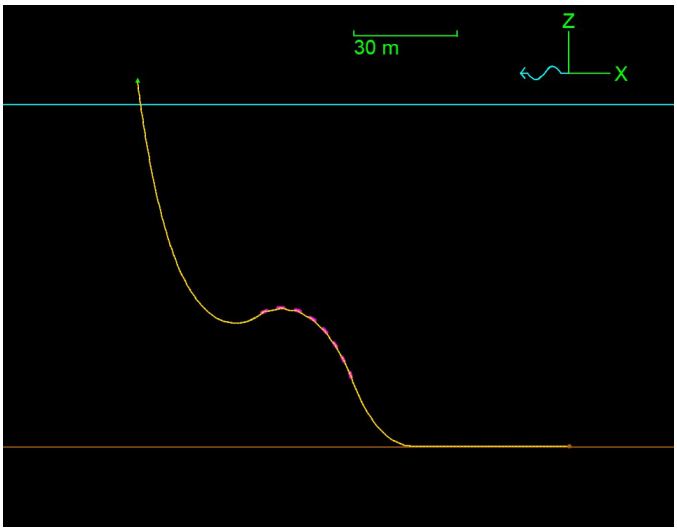
Reset drawing using analytic catenary

Up until now, lines drawn in the reset state haven't paid any attention to the seabed, known as the *quick catenary* algorithm. OrcaFlex users will be very familiar with the first of the following images, of a line hanging below the seabed in the reset state.

In version 11.0, the default behaviour for the reset state is to attempt to use the analytic catenary solver (the solver was introduced in version 10.3 for the purpose of performing quasi dynamic analysis) as shown in the second image. This will account for flat seabeds and buoyant line sections, and is intended to aid visualisation whilst model building. Note that it doesn't have any impact on calculation.



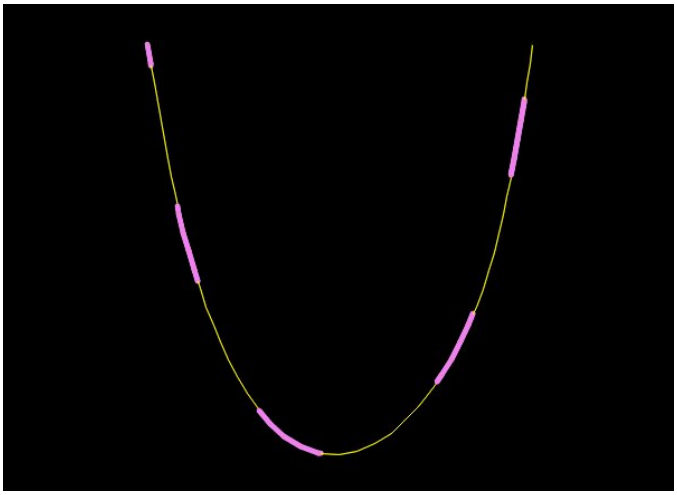
Line reset representation – quick



Line reset representation – analytic catenary

Slug flow drawing

There is now an option on the line data form to draw slugs in the 3D view. This is a very useful tool for visualisation of the slug flow settings, and is available for both wireframe and shaded graphics views.



Line slug flow visualisation – wireframe view

Line velocity and acceleration results logging

Line velocity and acceleration results can now, optionally, be logged (these values were previously only derived). This will result in more accurate velocity and acceleration results (and obviously other results which also use them) but will come at a cost, namely increased simulation file size.

New results variables

The following new line results have been added:

- x and y relative velocities
- drag and lift forces
- fluid inertia forces
- Morison forces

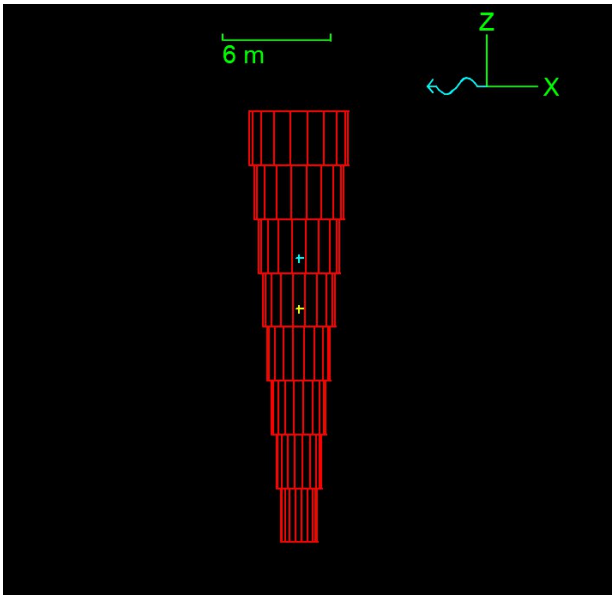
The accuracy of these results depends on the newly introduced logging of velocity and acceleration results mentioned in the previous section.

User interface enhancements

The OrcaFlex user interface is renowned for its simplicity and user–friendliness. However, we are always looking for ways to improve it. Here are a few changes for this release:

Vessel and 6D buoy origin drawing

Something that users have enquired about for some time is the ability to visualise the various origins for vessels and 6D buoys. Indicator marks can now be optionally drawn to show things like centre of gravity, centre of buoyancy, diffraction origins, etc.



6D buoy origins

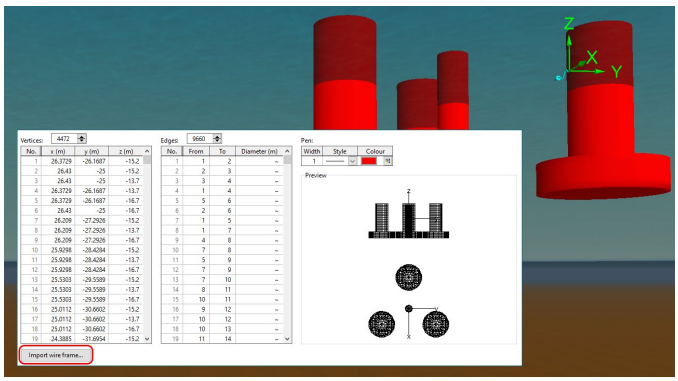
In the 6D spar buoy in the image above, the yellow mark indicates the location of the CoG (input data) and the blue mark indicates the centre of buoyancy.

Note that for a spar buoy the centre of buoyancy is automatically calculated by OrcaFlex based on its geometry.

This can be set as a preference and can also be modified from the view menu and with keyboard shortcut SHIFT+ALT+Y.

Panel mesh file drawing, wire frame and shaded graphics

Panel mesh files can now be used for both wire frame vertices and edges, and shaded graphics model import.

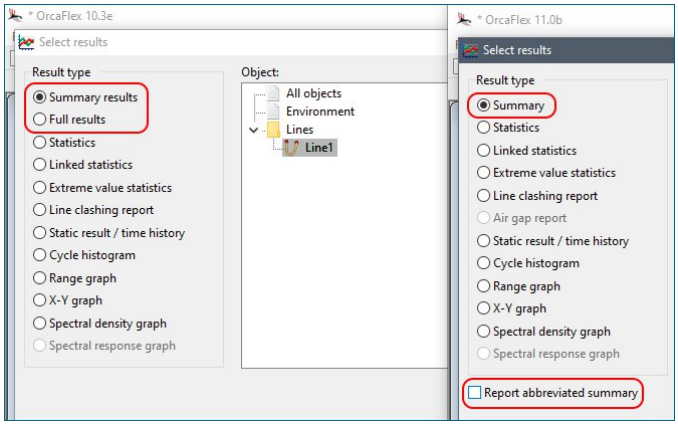


Wire frame and shaded graphics mesh import

The formats currently supported are WAMIT .gdf, Nemoh .dat and Hydrostar .hst.

Summary and full results types combined

This is a relatively minor change but may be of interest to our more experienced users. Prior to version 11.0, there were options for both **Summary** and **Full** results, the difference being that for lines, summary results reported only at the ends, and full results included tables for each segment on the line.



Results windows – v10.3 and v11.0

These results types have now been combined into one, providing by default the full results. A check box, **report abbreviated summary**, allows the reporting of only the line ends as with the previous summary results option.

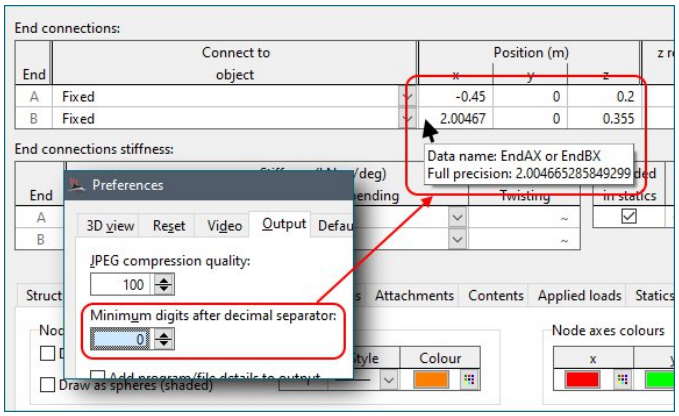
Summary results windows are immortal

In previous versions of the program, the summary results windows were closed by the program when a model was reset. This resulted in a suboptimal workflow when experimenting or debugging during model building, with the user having to reopen the results windows every time a new analysis was run.

These windows are now immortal, meaning that they stay open even when the model is reset. Instead the window is cleared and repopulated next time there are results available (i.e. when a new analysis is run).

Floating point / text conversion changes

It is now possible to specify, as a user preference, the minimum number of digits after the decimal point. If this value is set to 0, round numbers will have no decimal point, and for non–round numbers, the program will display as many as required (where exact values are specified), or as many as possible within the designated space.

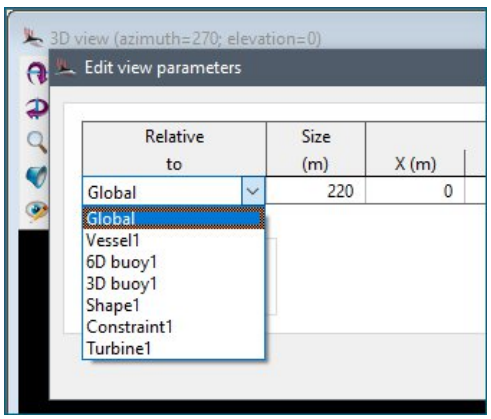


New display options for numbers in OrcaFlex

Hover over a number and the tooltip will show the full precision value.

View specification relative to...

It has long been possible to specify a view relative to a particular object. However, until now, 3D buoys and turbine objects have not been available as an option.



View parameters

This was a simple omission on our part which has now been rectified.

Software licensing

We have been working on integrating Flexnet Publisher (formerly flexlm) software-based licensing into OrcaFlex. This will allow us to offer dongle free and time limited licensing. The former is important for environments using virtual machines which do not have physical hardware ports, while the latter is useful for short term leases and loans, and when taking a computer into an environment where it is at risk of being lost or stolen (e.g. offshore).

Once in–place, this will allow us to investigate the possibilities for so–called 'OrcaFlex in the cloud', a workflow which some third parties are already offering, and a concept which is becoming commonplace in the world of software. But don't get too excited by this, as it will still be some time before we are able to offer cloud licensing ourselves!

Software licensing is being trialled internally but the tools for handling it with external clients are not yet in place. Look out for more news on this soon.

Other developments

Those are the headlines, now here are a few other improvements we've made to make your OrcaFlex–using life a bit easier.

Constraint hysteretic stiffness

When we introduced constraints in version 10.1, they immediately proved useful for a wide range of applications. They can now be used to model friction-like phenomena with the introduction of hysteretic stiffness. This will make the modelling of things like breakout friction in FPSO turrets much easier.

Wind drag loading for 6D buoys

Time to deal with another prior omission – in earlier versions of OrcaFlex, wind loads applied only to vessels, lines and 6D buoy wings.

Version 11.0 now enables wind drag loading on 6D buoys without the need to add wing elements.

Bringing your own wind to the party?

Now that you can include wind loads on 6D buoys, what if you wanted to define your own wind spectrum? This is now possible in exactly the same way as waves, with options for either user defined spectrum or user specified components options.

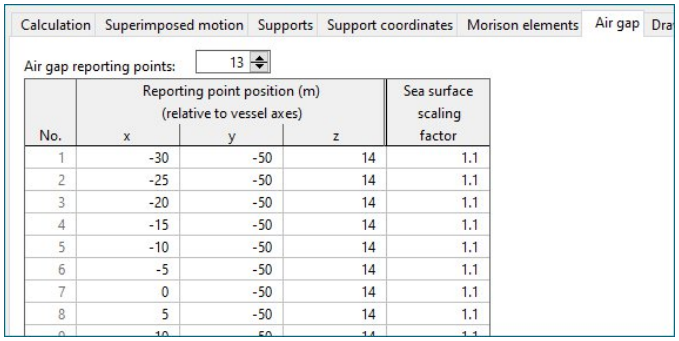
In addition, the ESDU spectrum is now available as a built–in option, allowing for the simulation of tropical cyclone conditions (previously the only options were the NPD and API spectra).

Vessel enhancements

Current and wind load: Prior to version 11.0, current and wind load data only allowed coefficients for surge, sway and yaw. This has now been extended to include heave, roll and pitch.

Sea state results: It is now possible to query a vessel for disturbed sea state results at specific points on the vessel – previously this required the inclusion of additional buoy or line objects.

Air gap results: As part of the above sea state results development, it is also now possible to query air gap results. These represent the vertical clearance of a chosen point on a vessel above a scaled instantaneous sea surface. This is something that wasn't available in previous versions and has its own dedicated page on the vessel data form:



Air gap page - vessel data form

Coming up

As always, we have an extensive list of developments we hope to be working on in the near future. It is too early to say exactly what will appear in the next version, but our current priorities are as follows:

Lateral soil modelling

We have talked for many years about the need to improve the lateral soil model in OrcaFlex, and this development will be particularly useful for those performing pipeline seabed stability analysis.

Restarts

Again driven by a desire to improve our pipeline analysis tools but also useful for many other applications, we are working on restarts.

Pipe temperature and pressure effects

Currently only possible using an expansion factor, another major piece of the pipeline analysis puzzle will be to allow for pipe thermal and pressure effects.

Improved mooring analysis tools

We still intend to work towards making mooring analysis easier in OrcaFlex, including a workflow tailored to this application, better extremes results, etc.

And finally...

In the last newsletter we presented our newly updated logo and also told you that a new website was coming soon...

Well, the new site went live in May, redesigned from the ground up with the aim of making it easier to navigate, optimised for mobile devices, and with some new information and resources.

We have had a great deal of positive feedback about the new website, and we hope you like it too.

Video content

There is a comprehensive videos page (orcina.com/resources/videos) which includes what's new videos for recent releases as well as a set of short OrcaFlex tutorial videos, designed to answer those commonly asked OrcaFlex questions. If you think the wider audience would benefit from a tutorial video which isn't yet covered, we would love to hear your suggestions. Contact information is on the back page.

Prefer to read? We've got you covered...

The resources section features a literature page (orcina.com/resources/literature) where you can download the usual mix of brochures and technical specifications, as well as some application-specific fliers. These include pipelay and offshore wind, and we are in the process of writing a flier for diffraction.

UGM materials – a hidden gem

There is a very useful archive of past user group materials in the resources section (orcina.com/resources/ugm-material). Whilst not a new addition, this wasn't easy to find on the old site, and consequently many users weren't aware of it.

What about us?

The old website didn't really divulge that much information about us as a company, so with the new one we have tried to present more of our human side. The 'About Orcina' section (orcina.com/about) provides information about the history of the company, as well as bios for a few of the less camera-shy members of our team...!

the back page

News

We aim to publish these Newsletters yearly to complement each OrcaFlex release. Around the same time we also produce a video (see orcina.com/resources/videos) as some features are best seen dynamically rather than on a static page.

We do also try to keep you up to date with developments on a more frequent basis. Our company **LinkedIn** page has been going for a while now, at linkedin.com/company/orcina-ltd. New followers are always welcome.

Our **News** page may be useful as a source of more detail on some of the v11.0 developments: these are all wrapped up in a recent post, orcina.com/news/orcaflex-110. Future posts will cover, among other things, 11.1 plans and developments.

Out and About

During 2019, as well as the usual mix of training courses and UGMs (see below), we were also involved in a number of exhibitions. 2020 will be no different, and will see us exhibiting at Subsea Expo (Aberdeen), Subsea Tieback (San Antonio), Oceanology (London), Global Offshore Wind (Manchester), OMAE (Florida), AWEA Wind Conference (Boston), Oceans (Mississippi).

We will also be attending OPT (Amsterdam) and Subsea Lifting (Stavanger).

Keep an eye on the website for up to date event information: orcina.com/support/events

Training

We continue to offer training courses, both for OrcaFlex and for the Python interface to OrcaFlex.

Planned courses are listed at orcina.com/support/training. In addition, we are always open to requests for client–specific training, whether it is our standard introduction to OrcaFlex, Python automation, or more advanced and tailored to your specific requirements.

User Group Meetings

In 2019 we again held 11 User Group meetings at various locations around the world, including Houston, London, Aberdeen, Stavanger, Amsterdam, Kuala Lumpur, Jakarta, Singapore, Perth, Shanghai and Rio. Content from these can be found at orcina.com/support/ugm. We also held our 'Introduction to Python' workshop in Houston and Ulverston.

Thanks to all who attended and contributed to their continuing success.

2020 UGMs will run between September and December – we'll post details of these and other events on orcina.com/support/events and on LinkedIn.

It is likely that we will also hold Python workshops in 2020: these are yet to be decided, but again, we'll post details as soon as we have them.

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