



OrcaFlex Newsletter

OrcaFlex 10.0 (released Oct-15) Now with Frequency Domain...

Editorial

Unfortunately the oil price downturn has been more persistent than many thought – ‘lower for longer’ and all that. Many colleagues have been affected but we hope that more stable times return soon and that this allows the industry to pick itself up.

However, these more difficult market conditions have not affected our general approach – we plan to continue adding the features that clients are asking for (where possible) and to offer the same client support that seems to be working so well.

To this end, OrcaFlex version 10.0 was released back in October and hit the streets shortly thereafter. Yes, the version number jumped from 9.8 straight to 10 – the addition of frequency domain, in what has always been a time domain package, being the main reason. As usual there are a host of good things in v10 most of which are described herein – see contents listing below.

In addition to technical developments to OrcaFlex, we’ve started a LinkedIn page and have added some videos to our website – see the ‘Back Page’ for details.

You’ll notice, and hopefully like, the new style for the newsletter – it’s the author’s fond hope that this will allow more timely newsletter production!

In this Newsletter

Editorial	1
In this Newsletter	1
Frequency Domain	1
Line-to-Line Connections / Generalised Constraints	3
Rayleigh Damping	4
Slamming on Lines	4
Mooring (system) Stiffness	5
Calculated Vessel Loading	5
Minor Enhancements	6
Pipelay Update	7
The ‘Back Page’	8

OK, so we start with the big one – frequency domain. The article runs on for a bit so, if you’re in a hurry, read the summary and then head over to the end of page 3 to carry on with other articles.

Frequency Domain

Now fast just got a lot faster – for some cases...

Summary

For those in a rush, here’s the quick take:

OrcaFlex was exclusively a time domain program (nonlinear, large displacement, etc.). Now v10 introduces frequency domain analysis alongside the existing time domain capabilities. Frequency domain analysis is linear, and so may not be appropriate to use for systems with significant nonlinearities, but, when used appropriately, **frequency domain is very much faster than time domain**. The built-in Fatigue Analysis has also been extended to allow fatigue damage by frequency domain.

...and, if you have more time, read on for the details....

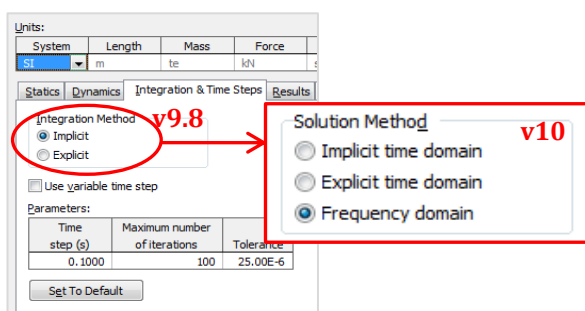
Introduction

OK, so OrcaFlex is widely recognised as the most productive *time domain* program in its peer group – solution times, automation, batch processing, and multi-threading all contribute to this. Time domain is fine for all types of system response, and is pretty much essential for systems exhibiting significant nonlinearities / systems where time-dependent process occur (eg., the operation of a winch at a certain point in time). But some applications respond more linearly, and for these cases frequency domain can be used – with the massive advantage that **frequency domain is orders of magnitude faster than time domain**.

So in this article we introduce the concept of frequency domain, how it’s implemented in OrcaFlex, how to get results, limitations of the implementation, and show some comparative time vs. frequency domain results for an SCR.

Implementation

A little more detail on the differences between time domain and frequency domain is given below. But for now, how is this all implemented in OrcaFlex? Well, for what turned out to be such a large development for us (given our 30 years of thinking in the time domain), the final UI in OrcaFlex is very subtle. From the user’s perspective it essentially amounts to some minor changes on the Integration & Time Steps page of the General Data form (see over) and some minor results re-packaging.



The first two options in v10 are just the renamed existing time domain options from v9.8. The new thing here is the third option – ‘Frequency domain’. And that’s it – all you do to run a frequency domain analysis is select this option and away you go.

Well, of course, while running frequency domain in OrcaFlex is that simple, there are other things to consider – see ‘*When to use Frequency Domain*’ below. But before that, let’s look a little more at how the time domain and frequency domain approaches compare.

Time and Frequency Domain Compared

Both time domain and frequency domain start with a user-specified wave spectrum (which is a stochastic description of the waves).

In the **time domain** the (stochastic) wave spectrum is discretised into a series of wave components and these are added (with random phases) to give a particular deterministic realisation of wave elevation. OrcaFlex has built-in load models (eg., Morison’s equation) to describe how the particular wave realisation generates loads on the structural objects. OrcaFlex also has response models which dictate how an object responds to loading (eg., axial stiffness). The system equation of motion is then solved *at each time* step to yield deterministic (and time varying) responses of the objects.

In contrast, **frequency domain** remains stochastic throughout. An OrcaFlex-generated ‘transfer function’, is applied to the wave spectrum to produce a response spectrum. The transfer function is actually two transfer functions – one describes how the wave spectrum generates loads on the objects, and a second one describes the response of those objects to the loads. Once we have the response spectrum (for, eg., tension) we then derive the usual statistical properties of this spectrum (see output in ‘*Frequency Domain Results*’ in next column).

However, in general, these transfer functions are nonlinear – but to be used in the frequency domain they must be linearised. Linearisation follows standard procedures to linearise about the static solution, but line-seabed friction and drag loading need special attention – as further described in the documentation.

When to use Frequency Domain

As discussed above, frequency domain is always linear. This means that if your system has important inherent nonlinearities, the use of frequency domain analysis may well give misleading results. But note that this is not an

OrcaFlex ‘issue’ – any frequency domain analysis is always linear.

But how to decide whether to use time domain or frequency domain? Well it’s yet another matter for the user’s judgement. For some systems it will be obvious which approach can be used – for example frequency domain can often be used for in-place drilling risers, but time domain is essential for installation analysis where the system geometry changes dramatically with time.

But there will be systems somewhere in-between where the decision is less clear-cut. Of course, for these cases, it’s trivial in OrcaFlex to set up both time domain and frequency domain simulations, compare the results and work out how significant the nonlinearities are!

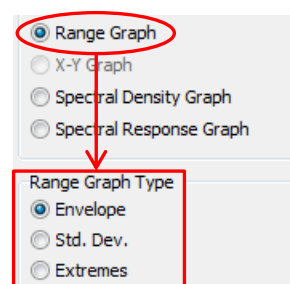
A typical work flow would normally combine static, frequency domain and time domain analyses. The proportions of each depend on where in the design spiral you are and how nonlinear the system is. Frequency domain is also commonly used for load case screening, usually to select a subset of ‘worst’ cases to go forward for time domain analysis.

Frequency Domain Results

Results reporting has seen some changes to make way for frequency domain.

The Statistics for a result variable is shown (re-presented to fit here). Frequency domain Statistics are described as the standard deviation about a mean (the static solution).

Statistics for Line1	
OrcaFlex 10.0a	
Variable	Effective Tension (kN) at End A
Static value	48.2948
Std. Dev.	0.6600
Most Probable Maxima	2.5153
Storm Duration (hours)	3.0
Periods(s) - Tz	7.5779
Periods(s) - Tc	3.9226
m0	0.4356
m1	0.0517
m2	0.0076
m3	0.0016
m4	0.0005
Bandwidth (epsilon)	0.8556



The presentation of range graphs has also changed, with Range Graph Type options being new.

Envelope (present in earlier versions) and Std. Dev. (new) are used with time domain. Std. Dev. and Extremes (new) are used with frequency

domain.

Implementation Limits

Clearly not all of the OrcaFlex functionality can be represented in the frequency domain – just think of time-dependent winches or time-dependent vessel time history files. Other things that cannot be supported in the frequency domain are external functions, nonlinear waves, time domain VIV and detailed winches.

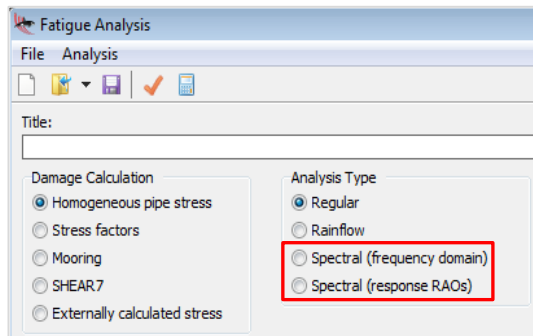
However, some features are not supported in the v10 frequency domain solver simply because there wasn’t time to implement them. These include Line Stiffeners, Line Contact Containment, Calculated Vessel, Sea State RAOs, Wind loading and variable Drag (Cd v. Re). Notwithstanding, the frequency domain code is pretty

capable and should cover most applications. And we plan to address these outstanding items as needed.

Fatigue analysis

Frequency domain analysis is also really useful for fatigue analysis – most fatigue damage occurs in relatively low seastates where we would normally expect the system response to be closer to linear. Here the speed of frequency domain analysis makes its use very appealing!

To cater for this the fatigue analysis capabilities in OrcaFlex have been extended – shown in the highlight below:



What is now called ‘Spectral (response RAOs)’ is what was previously known as ‘Spectral’ analysis (using response RAOs from time domain simulations with Wave Type = Response Calculation).

The new bit is ‘Spectral (frequency domain)’ which expects one frequency domain simulation to have been performed for each seastate before doing the damage summation.

Actually, there’s a second development here too – the Spectral (response RAOs) method has been extended to admit frequency domain simulations as well as time domain simulations!

Some Results

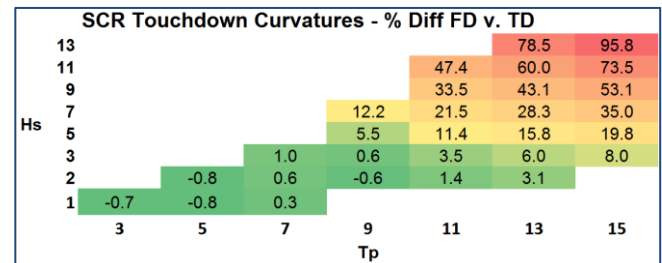
Some results comparing time domain and frequency domain were presented during the 2015 OrcaFlex UGM round. The details can be found at orcina.com/Support/UserGroup/2015, but here’s a very brief summary:

A 9" SCR was analysed for 1000m water depth, 29 H_s – T_p loadcases (small for illustrative purposes), 0.5m/s surface current with power law profile and wave kinematics cut-off below 400m. The time domain simulations were for 1hr, $\Delta t = 0.25s$ and 1000 wave components. The analysis metrics show:

- For a single loadcase, time domain took 55 minutes and frequency domain took less than 1 minute.
- For all loadcases, time domain took 210 minutes and frequency domain took 4 minutes.
- For the fatigue post processing of these loadcases, time domain took 8 minutes and frequency domain took 30 secs.
- Total file size was 7490MB for time domain and 583MB for frequency domain.

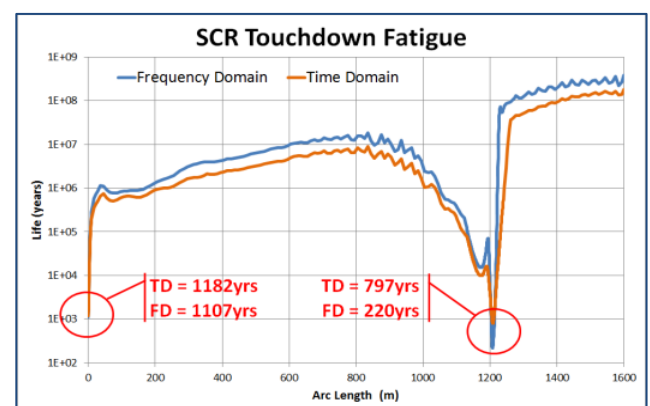
OK, but what about the results – speed isn’t everything if the results don’t stack up!

Well, SCRs are dominated by fatigue in the touchdown zone – curvature being a good proxy for this. The plot below shows the % difference between time and frequency domain results:



Agreement is good in the lower seastates and much worse in higher ones. This is exactly as we would expect – time domain is capturing the much greater nonlinear response at these higher seastates, something frequency domain is simply not able to do!

And how does the fatigue life look? The plot below shows this:



Frequency domain does a pretty good job in the hang-off area where the nonlinearities would be relatively small. But, as evidenced in the previous plot, fatigue life in the touchdown area is out by nearly a factor of 4.

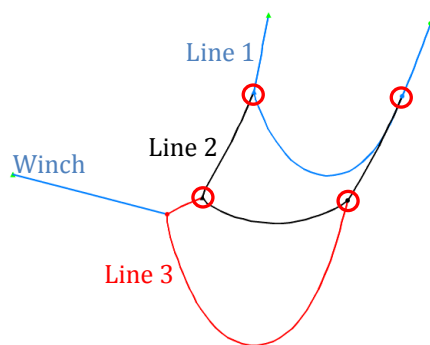
Conclusion

Well, there we have it – frequency domain finally in OrcaFlex sitting very easily alongside time domain ☺. Just make sure you understand when it’s appropriate to use and frequency domain will be an extremely powerful addition to your toolset. 🐙

Line-to-Line Connections / Generalised Constraints

Often asked for and now finally available...

Actually, the article headline is there to grab your attention! True, we can now directly connect lines to other lines, see screenshot below where a winch is used to pull a bunch of connected lines off to the left. Note the lack of intermediate 3D or 6D buoys as intermediate connection objects – as highlighted by the circles!



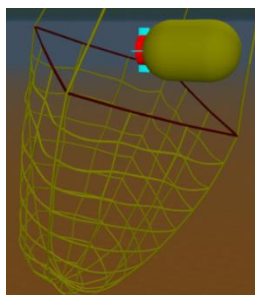
And if that's all you need, then you can stop reading here! But don't, because this is only one outcome of a great deal of work to generalise the internal handling of connections. The next release will allow constraints on individual connection degrees of freedom to be modelled. We've already been experimenting with this internally, and it's been quite a revelation!

V10 also allows other objects to be chain connected, eg., 6D buoys – so now a 6D Buoy used as a turret can be directly connected to a Vessel even though it has risers and moorings in turn connected to it.

So why is all this happening now? Well, since the advent of implicit integration in 2007 (v9.0) we had, for various reasons, maintained separate implicit and explicit coordinate handling code. But the advent of frequency domain, along with consistent user requests to allow more general constraint modelling, means that we have finally unified these codes. So now, not only is functionality like Line-to-Line connection possible, but future developments are much easier to implement and test – and that works to everyone's advantage ☺!

But is there no downside? Can it all be a 'free lunch'? Well, there are two consequences, the first real and second less so:

- Unification of the codebases means that the Explicit code now runs 20%-30% slower than before (depending on the model). We decided that this was acceptable in light of the benefits of unification, and that Explicit is mostly used for checking, not for production runs.
- The other consequence is that all our wonderful net models need to be re-worked! The screenshot shows someone fishing for a torpedo(!), but the net is built using Line-to-Line connections.



So, expect Generalised Constraints in the next release (v10.1, cOct-16) which will allow straightforward modelling of hinges, articulations and other constrained DoFs. But in the meantime enjoy being able to chain objects together. 🐟

Rayleigh Damping

Geometric stiffness – in or out...?

In general the system damping matrix is difficult to derive. Consequently Rayleigh damping is widely used, and this is expressed as:

$$C = \mu M + \lambda K$$

where C, M and K are the damping, mass and stiffness matrices, and μ and λ are the mass and stiffness proportional Rayleigh damping constants.

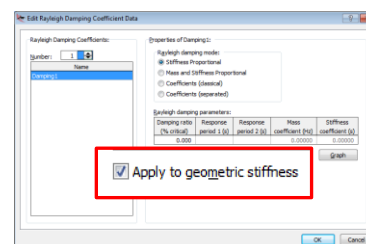
In OrcaFlex Rayleigh damping applies only to structural mass and stiffness terms associated with Lines, and it represents the damping of energy transmission along the line.

But 'stiffness' has two major contributions – material (the material force-extension curve) and geometric ('additional' stiffness from, eg., deflection). Material stiffness is always included in K. But opinion differs on whether geometric stiffness should be included in K, ie.:

- Geometric stiffness is not a property of the material and should therefore be excluded.
- Geometric stiffness can be the dominant contribution to bending stiffness, and therefore should be included (in order that target damping ratios can be achieved).

Previously OrcaFlex unilaterally imposed option (i). But for systems dominated by geometric stiffness this meant that it was not feasible to apply a specific damping ratio!

Having thought long and hard about this problem, we decided that there was not a 'right' or 'wrong' way to treat geometric stiffness within Rayleigh Damping. So we pass the decision to the user with a simple check box on the Rayleigh Damping Coefficients form:



This development was prompted by feedback from a number of our users and we are grateful for their patience and help. 🐟

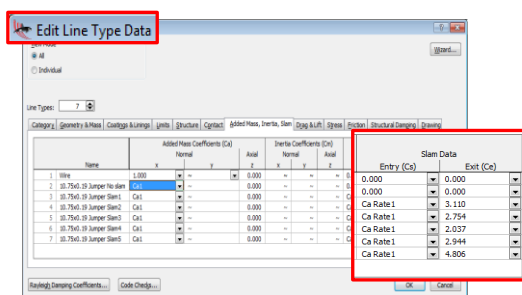
Slamming on Lines

Was on 6D Buoys, now on Lines too...

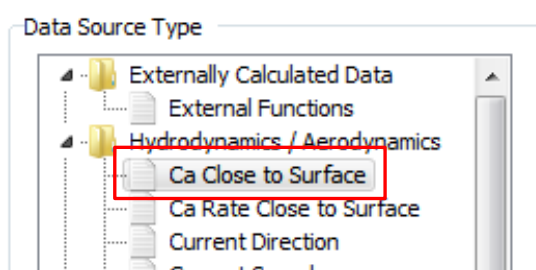
OK, a long write-up is not needed on this, but enough just to wave the flag and say that **slamming loads can now act directly on lines** ☺!

In OrcaFlex v9.5 (Oct-11) we introduced slamming on 6D Buoys. In v9.8 (Oct-14) we further enhanced this model. And in the v10 release, we can now do the same 6D Buoy

slamming calculation directly on Lines – and just to prove it:



In addition, **Added Mass Coefficients for a Line can now be a function of submergence**. In reality added mass is affected by proximity to a boundary – sea surface in this case. So now, as well as still being able to specify constant added mass coefficients, these can optionally (via the Variable Data form) be a function of submergence, viz:

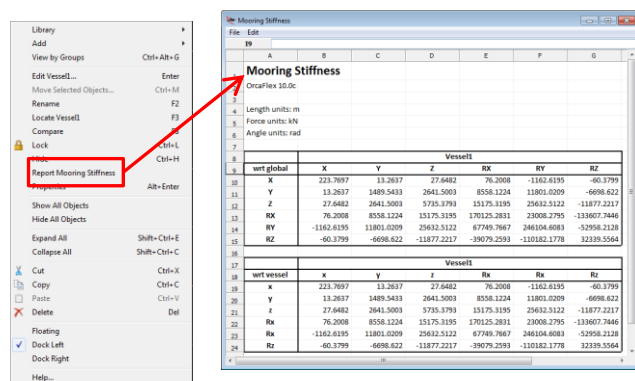


Happy days! 🐟

Mooring (system) Stiffness

Mooring system stiffness at the Static solution...

OrcaFlex can now derive the tangent 'mooring' system stiffness matrix. First solve Vessel + Line(s) in statics, then right click on the vessel in the Model Browser and select Report Mooring Stiffness. This produces a 6x6 matrix (wrt. both Global and Vessel coordinates) reporting the system stiffness in surge, sway, yaw, roll, pitch and heave due to movement in each of those DoFs in turn:



This matrix is intended for use by moorings engineers in order to derive displacement RAOs from the load RAOs generated by a diffraction program.

Note that although this is called Mooring Stiffness, it actually contains all stiffness contributions from other connected objects, but Hydrostatic Stiffness data (from the Vessel Types Data) form is not included.

Further, if you have n multiple vessels connected in the same system, and you multi-select those Vessels in the Model Browser, then you'll see a $6n \times 6n$ stiffness matrix.

Related to this development, the Multiple Statics feature (previously available from the Calculation menu) has been removed. This was originally added to allow mooring restoring curves to be more easily derived. However, we suspected that it was not being used much, not least because this can be better done through OrcaFlex's automation tools. So it was removed to simplify the code and UI. Apologies if this causes any unforeseen problems – if does, please contact us and we'll help with alternatives to achieve the same. 🐟

Calculated Vessel Loading

A hard-to-grasp problem now resolved...

Normally, fluid loading on vessels is solved in the frequency domain using a diffraction program. As part of the theoretical derivation, quantities are expressed as a Taylor series expansion – eg., hydrodynamic force would look something like:

$$F = F^{(0)} + \epsilon F^{(1)} + \epsilon^{(2)} F^{(2)} + \epsilon^{(3)} F^{(3)} + \dots$$

Where $^{(0)}$ are equilibrium terms (eg., hydrostatic pressure), $^{(1)}$ are 1st order terms due to wave pressure and induced vessel motion, $^{(2)}$ represent 2nd order terms, etc., (see CMPT *Floating Structures: a guide for design and analysis*, Vol 1, p. 3-133). With the maths worked through and the same order terms $\epsilon^{(i)}$ collected together, then 2nd order terms (higher order terms are not usually considered) can be expressed as:

- A 2nd order force integrated over mean hull position.
- Products of 1st order terms integrated over mean hull position.
- A 1st order force integrated over a 1st order correction to hull position.
- A zeroth order force integrated over a 2nd order correction to hull position.

We call the last 3 contributions '*common second order loads*' (CSOL). These cause confusion because they also arise *naturally* from a time domain simulation. But if they are also present in the imported diffraction-derived QTF data, there is a danger of double counting! However, all is not lost as double counting can be avoided by:

- Preventing the CSOL from arising in the time domain OrcaFlex simulation, or
- Modifying the diffraction calculated QTF data before they are used in OrcaFlex.

Previously OrcaFlex adopted Method (a). This involved filtering vessel response frequencies, something we've realised is difficult to achieve reliably in practice. This was revealed in a handful of cases where OrcaFlex

predicted unreasonably large roll responses. So after much work we've implemented Method (b), ie., OrcaFlex now subtracts the CSOL from the diffraction QTF data before use.

Note that the user continues to supply the same diffraction data and OrcaFlex handles all the subtraction internally. OrcaFlex then uses, without modification, the CSOL which arise *naturally* in the time domain.

There are two important implications arising from this change:

- 1) Vessels results using only 1st order data will change because CSOL naturally arise in time domain simulations and these are no longer being filtered out.
- 2) Whilst the Vessel Filter no longer applies to diffraction data, it's still needed for OCIMF, Wave Drift Damping, Manoeuvring and Other Damping.

This topic has occupied a lot of development time over the last couple of years. But we're confident that OrcaFlex v10 is now taking the best approach. 🐟

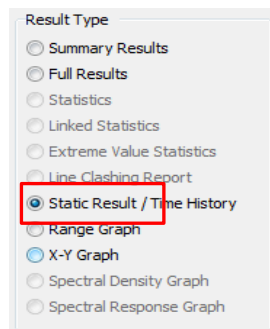
Minor Enhancements

Some of the more minor developments that are new in OrcaFlex v10 are listed below...

Static State Results

Previously in OrcaFlex it was possible to get all the static results for all objects through the various OrcaFlex automation tools. But through the user interface only a much reduced set of static results could be obtained (obviously in dynamics, it was possible to get the full set of results for all objects via the UI).

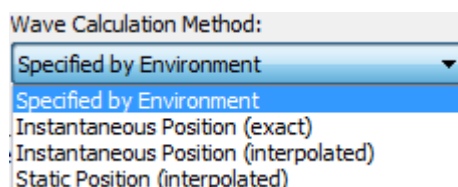
We used to work-around this by running very short dynamic simulations and then looking at results at the start of the simulation – really not very elegant! But now (actually since v9.8c) the Results form has a new Static Result / Time History option (was previously just Time History)....and this magically opens the way to all static results for all objects 😊.



Wave Kinematics

In v9.8 we introduced the Wave Calculation options to improve computation efficiency. But these options applied globally, ie., they were model-wide.

Now in v10 it's possible to specify a per-object override to the model-wide preference. Each object supporting the Wave Calculation method has a new drop down box on the data form – see screenshot below:



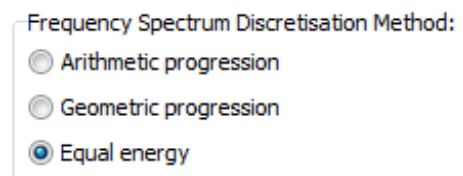
The first option is the model-wide choice from the Wave Calculation page on the environment Data form, and the remaining choices allow this default to be overridden for each object.

Wind Spectrum

Two enhancements here: (i) It's now possible to associate an elevation with the re-named Ref. Mean Speed. The latter is still the mean 1-hour return period wind speed at 10m elevation, but the **new Elevation data** item specifies the elevation at which the mean wind speed is to be calculated and to parameterise the spectrum. (ii) It's now possible to specify the **Min & Max Frequency** range containing all the wind energy.

Wave Spectrum Discretisation

In v9.8 we had 3 variants of equal energy discretisation (*Legacy, 9.3a & 9.5d*). Each represented various improvements, but we retained the older versions for the sake of backwards compatibility. In v10 we now have:



Both **Arithmetic progression** (equal frequency spacing; $f_{i+1}-f_i$ is constant) and **Geometric progression** (ratio of adjacent frequencies; f_{i+1}/f_i is constant) have been included for completeness. Neither are ideal (in our opinion), with Equal Energy nearly always being the better option.

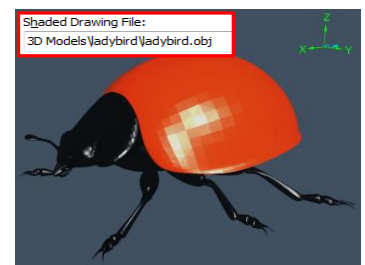
Equal energy: This is the default, long-standing and preferred option which corresponds directly with the previously named *9.5d* option. Note that the *Legacy* and *9.3a* options will still be explicitly presented when opening older data files which used those methods.

Shaded Drawing

Shaded Drawing files have been in OrcaFlex for 10 years now – that long!? .x files are the native format for the DirectX graphics library we use. However, it turns out that this file format is not so widely used, and so whilst convenient for us, it was less so for our clients.

So v10 adds support for Wavefront OBJ format (supported in many 3D modelling packages) – see right for our nice *ladybird.obj* image.

We hope this makes things easier 😊. 🐞



Results

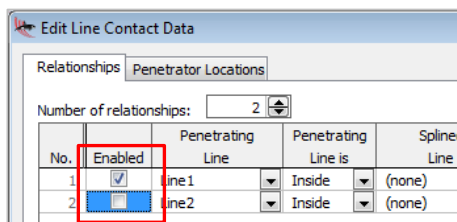
In 9.8c we introduced **Max pipelay von Mises Strain** for users doing pipelay. It's different from other equivalent strain definitions – eg., shear & radial strains are neglected, and zero is assumed for Poisson's Ratio.

Spectral Density Graphs were always available by right clicking a Time History graph. But the advent of frequency domain prompted us to make this result more accessible – so it's been added to the main Results form and can be used for both time and frequency domain.

New results **Dynamic x|y|z/Rx|Ry|Rz** have been added. These are the 3 displacements and 3 rotations for any degree of freedom, and they represent the dynamic variation about the static value.

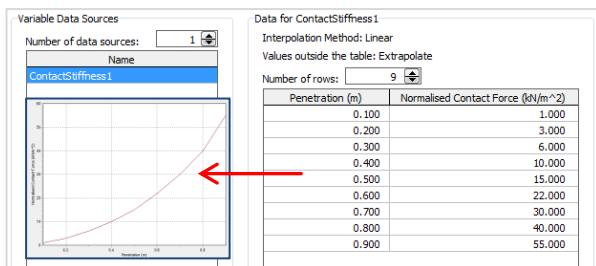
Tabular Values shown in the UI can now be exported in **xlsx format**. Unless 'Default File Type' is set otherwise, xlsx is the default, but xls format is still there if needed.

We can now **disable Line Contact Relationships**. Previously they had to be deleted to investigate their effect! That seemed silly, so there's now a simple check box to Enable, or not, each relationship:



Nonlinear Contact Stiffness

The contact stiffness for Seabeds, Elastic Solids, Line Contact and Supports can now be nonlinear (tabulated on the Variable Data form), viz:



Applicable to many contact situations – in particular we see it being used for modelling fenders and mating units.

Pipelay Update

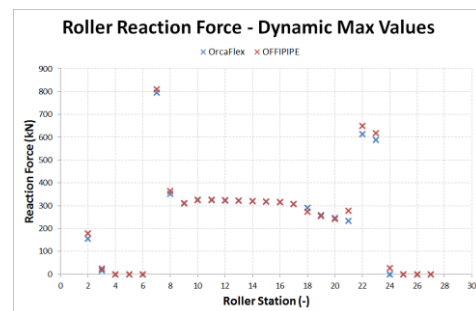
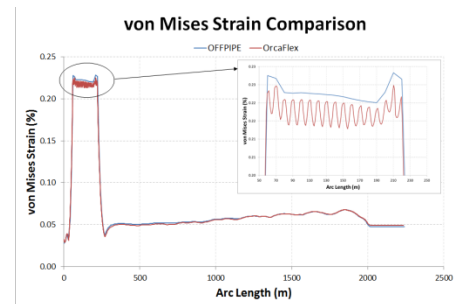
Some OrcaFlex-OFFPIPE comparison results...

The last OrcaFlex (v9.8) release saw major developments benefitting pipelay users, including Supports UI, pipelay code checks, and Lay Table automation. These were described in detail in the last newsletter. This update covers more details on the comparison between OrcaFlex and OFFPIPE that we only alluded to in the last newsletter.

It was, of course, difficult to decide what cases would be suitable. In the end we used two – one at 700m water depth and one at 150m. For both, OrcaFlex used 10 elements between stinger supports, whereas OFFPIPE used its default of 1 element between supports for the 700m WD case, and 16 elements between supports for the 150m WD case.

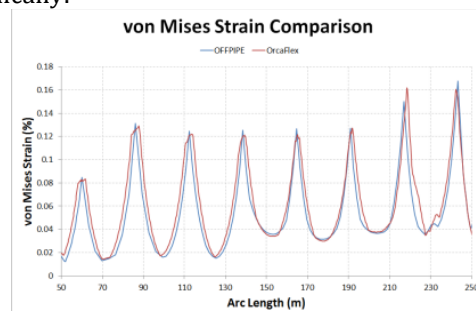
Results @ 700m WD

Statically, layback differed by less than 0.01%, bottom tension differed by less than 0.2% and stinger tip separation differed by less than 1.1%. Dynamic results are shown below:



Results @ 150m WD

Statically all results were effectively identical. Dynamically:



Discussion

Initial differences in results were found to be due to:

- Correct tensioner placement in OrcaFlex (on barge at pipe start) correctly allows minor pipe movement over rollers, slightly flattening peaks in results.
- OFFPIPE dynamic results equate to a mix of OrcaFlex min and max range graph results.
- High frequency damping: OrcaFlex fully captures stress waves travelling along the pipe.
- Slight differences in the specification of nonlinear moment-curvature data.
- Subtle differences in definitions of von Mises strain.

Once these were accounted for, the results (above) showed near-perfect agreement.

Conclusion

Clearly, OrcaFlex and OFFPIPE give near-perfect agreement if used comparably. This, together with the usual ease-of-modelling in OrcaFlex and Orcina's dedicated support, makes OrcaFlex the natural candidate for your pipelay applications.

The 'Back Page'

News

In an effort to be more communicative about things we're doing and technical stuff of interest, we've started a **LinkedIn page**. This can be found at [linkedin.com/company/orcina-ltd](https://www.linkedin.com/company/orcina-ltd). Do have a look and please follow if the info looks useful to you.

In yet another effort to communicate better (and move into the 21st century!), we've added a **videos page** to our website – this can be found at orcina.com/SoftwareProducts/OrcaFlex/Videos. We're starting small (but perfectly formed?) with the following content:

- Videos highlighting the major features in each release of OrcaFlex (v9.8 & v10 are there).
- Tutorial videos showing how to use OrcaFlex. We've started with pipelay analysis / how to get lay table results, and we plan to add more of these over time.

We continue to offer **OrcaFlex Training courses** – both Client Specific, Open and Workshop formats. If these might be of interest, just let us know. Open Training courses as well as all up-coming events we're attending are to be found at orcina.com/UpcomingEvents. This is regularly updated, but we'll post on LinkedIn too.

Out and About

As well as the usual mix of training courses and UGMs, 2015 saw us exhibit at: Subsea Expo, OPT, OTC, OMAE, Offshore Europe and Subsea Lifting, and we also visited The Deepsea Mining Summit.

For 2016 we're exhibiting at: Subsea Expo (Aberdeen), OPT (Amsterdam), Oceanology (London), The Subsea Tieback Forum (San Antonio), OTC (Houston), OMAE (S. Korea), and we're planning to be at Oceanology (Shanghai) and Subsea Lifting (Stavanger). And there will be a round of UGMs between September and December – see orcina.com/UpcomingEvents for details and we'll post on LinkedIn too.

OrcaFlex User Group Meetings

2015 User Group attendance showed our best ever figures, with over 450 colleagues attending the 11 global events we organised. We were delighted to add China and London as new locations for 2015, in addition to our regulars at Houston, Rio, Aberdeen, Norway, Amsterdam, Perth, Kuala Lumpur and Singapore - we look forward to return trips to all these venues in 2016.

2015 UGM content and a pointer to 2016 event info can be found at orcina.com/Support/UserGroup – keep an eye on this for updates and we'll post on LinkedIn too.

Future OrcaFlex Features

Our development list depends largely on client feedback. This comes throughout the year, but a major input arises from the feature feedback notes you give us on the UGM feedback forms – so a big thank you to all who kindly take the time to do this. But suggestions are welcome at

any time, and are especially useful if you can explain why a suggested feature is important. A review of all feedback has resulted in the following development plans:

- Features related to mooring analysis.
- Advanced constraint modelling.
- Line results additionally at nodes.
- Line Payout.
- Restarts.
- Histogram results.
- Variable Line added mass near the seabed.
- Support for large multiprocessor PCs.
- Software-based licencing (ie., without dongles).

These are features which we're either working on or currently considering for the next couple of releases. But, as ever, this is not a definite commitment to add these features – some may take longer to implement, and some might not be technically possible. And the list above contains just the headline features – we add many other improvements in each development cycle.

Orcina Agents

Orcina is supported in its marketing and technical support activities by the following agents:

USA & Canada

Paul Jacob & Dongmei Chu

pj@jtec-tx.com, +1 713 398 9595

dchu@heronoffshore.com, +1 832 725 2438.

Malaysia, Indonesia & Singapore

Herman Perera

herman.perera@zee-eng.com, +60 (03) 7877 8001.

South Korea

Hyunwoo Jang

hyun.j@sacsko.com, +82 2 421 8018.

South America

Nelson Galgoul

nsg@nsg.eng.br, +55 21 99995 9212.

India and Middle East

Tarun Rewari

info@aryatech.net, +91 11 46 01 81 02.

China

Betty (Xuan) Zhang

xzhang@richtechcn.com, +86 21 6485 0066–8063.

If you have any questions, comments or general enquiries, please contact us at

Orcina Limited

+44 (0)1229 584 742

orcina@orcina.com

orcina.com

