Orcina
Professional software for engineering professionals
Newsletter
www.orcina.com
December 2006

For the release of OrcaFlex 9.0…
…now much faster than before!

Welcome to the latest issue of the Orcina newsletter. You may have gathered from the opening title that we have now issued the much anticipated speeded up version of OrcaFlex. As a result of this major enhancement, and other significant new features, we have moved up from version 8.7 direct to version 9.0 with no interim releases. As you might expect, this major development is given a lot of space in this newsletter, but of equal significance are the findings from a comparison of the results from OrcaFlex and Flexcom – this is described in detail on page 4 and is well worth a read.

Other new features we describe here include a new way to perform static solutions (whole system statics) which offers better performance for many cases, frequency dependent added mass and damping, and a short list of some of the other developments.

As with much of the industry, we have had a very busy 12 months, which has resulted in a large increase in software sales worldwide. We believe that this continued success re-affirms our position as the leading supplier of marine dynamic software in the industry. Despite this major release, our software development continues apace, and we anticipate releasing significant new features over the next 12-18 months.

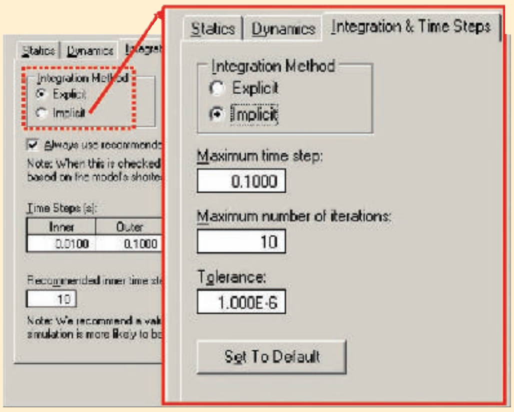
As always, we hope that this newsletter is useful and informative. If you would like to make suggestions for future content, or comment on what's already here, then please get in touch.

In This Month's Newsletter

Implicit Integration

'Go Faster' OrcaFlex now available – with both implicit and explicit time integration schemes.....

The new implicit integrator in OrcaFlex gives much faster simulation times for certain types of systems – typically those with high axial stiffness (SCRs, TTRs) and / or fine segmentation (bend stiffeners, tapered stress joints, etc). Our experience thus far is that the new implicit scheme will run between 10 and 40 times faster than the pre-existing explicit scheme, although we've recently had an extreme case where a speed up of 850 times was achieved! However, not all systems are faster with implicit integration. There are important issues (common to all types of time domain numerical solutions) concerning the accuracy, numerical robustness and speed of implicit and explicit time integration schemes. The longer article on page 2 starts to unpack these issues, and more details can also be found on our website (www.orcina.com/Support/ImplicitIntegration).



A key aspect of this new development is that OrcaFlex now uses both classes of time integration scheme (TIS) – see screenshot. This is very important, as no one type of scheme is generally recommended for all types of problems: Usually explicit TISs are used for short duration phenomena (snatching, contact, etc) and implicit TISs for slow changing effects. The main article on page 2 says more about this.

Each TIS has further options - those for the explicit scheme should be well known and we won't cover these further here. The new implicit scheme has several user defined data items (although leaving the default values is usually fine):

Max size of time step:	The implicit integrator employs a variable time step. The algorithm used to control the time step may increase and decrease the time step size, but the time step won't go larger than this user-specified value.
Max no. of iterations:	All implicit TISs perform dynamic equilibrium iterations at each time step.This data item limits the maximum number of iterations at each step.
Tolerance:	The iterations are performed until a certain accuracy (tolerance) is achieved.

We have already received a lot of very positive feedback on this, and while there is still some work to be done to improve things even further, we have already seen a massive benefit from this development.

Whole System Statics

A new option to further improve already excellent statics convergence…

Most line dynamics software packages are not used to handle the wide range of analysis problems that OrcaFlex is routinely used for. Although it may seem counter-intuitive, static calculations are generally harder problems to solve than dynamic calculations. OrcaFlex has always handled statics very well but this new feature improves its capabilities yet further.

One of the big advantages of the implementation of the implicit time integration scheme is that the stiffness matrix for the whole system is now formed. This means that we can now offer an alternative method for static convergence - called whole system statics (WSS).

We've called the statics convergence method in previous releases (and still retained in version 9.0) 'Separate Buoy and Line statics' (SBLS). Here we had an inner loop for line static equilibrium and an outer loop for static equilibrium at line ends - if a line was attached to a buoy or a vessel, for example. This hybrid approach works well in many cases, but not always! For example SBLS typically struggles with models that include multiple 6DoF Buoys. However, most of these cases are much more readily solved using the WSS algorithm rather than the traditional SBLS approach. By default OrcaFlex gives you the familiar SBLS method, but the Statics page on the General Data form now gives you the option of selecting the WSS approach if required.

Our experience to date suggests that using the WSS approach will make cases with tricky statics convergence work much more robustly. We're sure that you will find these same benefits, but, as ever, do let us have your feedback.

Orcina

Implicit Integration

We've had a very brief introduction to the new implicit integrator on the front page. Whilst the implicit integrator offers impressive levels of speed-up, there is no such thing as a free lunch! Both types of time integration scheme have their advantages and disadvantages. Here we give a little more detail about each of these schemes, what implications they have for analysis and some indicative results.

Principles of Time Integration Schemes (TISs)

Before going further, here is a table giving a general overview of each scheme and some of their principal characteristics. Unless otherwise stated these features apply to any use of these schemes in numerical analysis, and are not OrcaFlex specific:

Explicit	Implicit
$X_{n+1}=F_{exp}(X_n,\Delta t)$	$X_{n+1}=F_{imp}(X_{n+1},\Delta t)$
• Simple, no iteration required. • Time step limited, ie is conditionally stable. • Good for short duration phenomena (clashing, snatching, axial waves). • Constant timestep throughout simulation (as implemented in OrcaFlex).	• Stable with large time steps but requires iteration. • Large numbers of iterations can lose the speedup benefit. • Can lose accuracy at large time steps and miss short duration phenomena. • Variable timestep during simulation (as implemented in OrcaFlex).

As is well recognised in the industry, explicit TISs are very well suited to modelling systems with fast, rapidly changing responses, eg, contact and snatch load problems. However, explicit schemes do suffer the disadvantage of requiring shorter time steps (to adequately resolve the response) which normally results in longer simulation times. In contrast, implicit schemes allow much larger time steps to be used, but with the potential that rapidly changing responses might not be captured properly. However, implicit schemes have the major advantage that for stiff systems (eg SCRs) and where transient effects are not important, the simulations can run much more quickly than with explicit schemes.

These characteristics are widely known in the numerical modelling community. Major general purpose FE programs such as ABAQUS recognise this by supplying two versions of their program – one explicit for modelling contact, explosion etc, and one implicit for performing faster simulations of slowly changing responses.

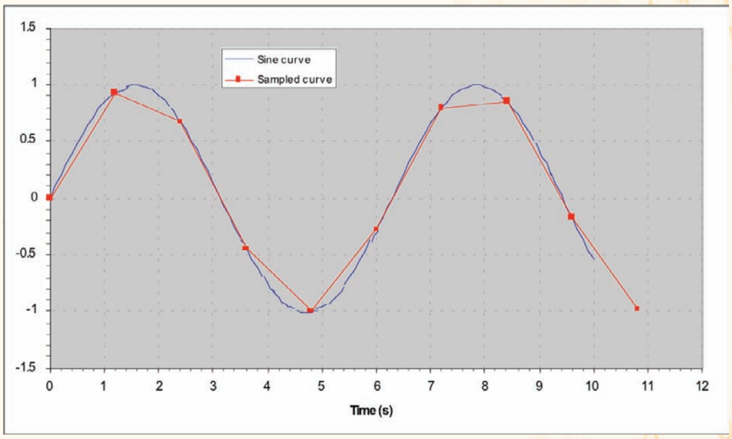


Figure 1: Sketch of Response Time History

So why do these schemes exhibit these characteristics? Consider Figure 1. This shows a time history for the perfect solution (sine wave in this case) for our result of interest (tension, curvature, etc), and one coarser discretisation.

In numerical analysis we are discretising not only in space, but also in time. In time we always have to make an approximation to the ideal solution because it's not possible to use infinitely small time steps. We try to use the largest time step possible (to reduce simulation time), commensurate with achieving an acceptable level of accuracy. The sampled curve shows what happens to the results if we use a large time step – we can see that for a fixed time step increment which is too large, we degrade the quality of the results.

Obviously large constant time steps only give results at much coarser intervals – with the possibility that the peaks of the response may not be properly captured. The stability properties of explicit schemes mean that if they are stable, then they will nearly always be accurate. With implicit schemes, it's quite possible to have stability without accuracy, losing the high frequency responses.

Explicit TISs are conditionally stable. In the OrcaFlex explicit implementation the 'Set as Recommended' option actually works out the shortest undamped natural nodal period in the model, and suggests a time step of 1/10th of this (the recommended default for OrcaFlex version 8.7 onwards). This value is nearly always suitable to accurately integrate the response.

With implicit schemes, there is no such requirement on time step size. Consequently the user is at liberty to select time steps as they wish, usually with an upper bound of the order of 0.1 to 0.5s for SCR dynamics. Under these conditions it is even more important that a sensitivity study on the effects of time step be performed – as we will see later!

There are several other important points to note with the implicit integrator:

1. Implicit schemes (generally, not just in OrcaFlex) require iterations at each time step for the solution. Larger time steps result in more iterations being required. At some point, the speed advantage gained from using larger time steps is outweighed by the increased time required to perform more iterations. Consequently, above a certain problem dependent threshold, using larger time steps can result in slower simulations.
2. The tolerance is the user defined acceptance criterion on the dynamic equilibrium accuracy achieved at each time step. A lower tolerance means more iterations will be performed, giving more accurate results, but longer simulation times. A larger value has the opposite effect, producing more erroneous results, but faster simulations.
3. The variable time step implementation uses the number of iterations at the end of each time step to decide on the size of the subsequent time step. If more iterations are being performed then a shorter time step will be used for the next step. Fewer iterations results in a larger time step for the next step (up to the maximum set by the user).
4. OrcaFlex reports the estimated time to completion in the message area of the window. Assuming no other processes are running, then the time to completion reported for the explicit scheme will be fairly accurate. However, for the variable step implicit integrator, the number of iterations at each time step and the time step size itself will change throughout the simulation. Consequently the estimated time to completion reported by OrcaFlex is sometimes not a reliable indicator, especially early in a simulation, although this improves as the simulation progresses. The actual simulation time can only be determined after the simulation completes, and can be found from the Properties on the General Data form of the corresponding simulation file.
5. The time history of time step and number of iterations can be obtained as standard results variables. These results are available with the General object selected on the results form.

So, having identified some of the main issues with these different classes of TISs, how do solutions between the schemes compare? Before the details, it's worth noting that the timing comparisons below are all made with the explicit inner time step set to 1/10th of the shortest natural nodal period (SNNP) as recommended in v8.7 and above. Older versions of OrcaFlex used time step equal to 1/20th of the SNNP. For users only familiar with the 1/20th rule, the speedups reported below can be doubled!

Stiff Systems - an SCR

Stiff systems force an explicit routine to use small time steps, and for these cases the implicit routine can be a real benefit. Here we look at a typical SCR system. The explicit time step is used with the 1/10th rule. With the implicit integrator (Δt_{max}=0.1s), the runtime is **16x faster**.

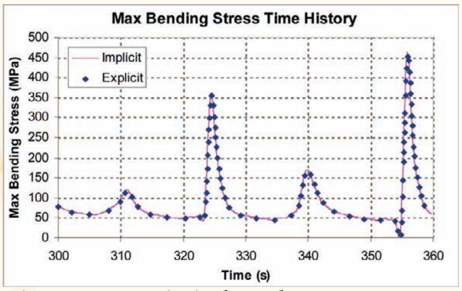


Figure 2: SCR Principal Results

So a much faster solution, but how about results accuracy? Figure 2 shows the differences for bending stress. The agreement is excellent, showing that the 16x speedup still produces accurate results.

Fine Segmentation (Bend Stiffener)

Here we have a riser system with bend stiffener included - a system characterised by lower stiffness but finer segmentation. This detailed model is common for fatigue analysis where a large number of cases needs to be run. The bend stiffener fine segmentation leads to small explicit time steps. With the implicit scheme (Δt_{max}=0.1s), **runtime is c40x faster(!)** and Figure 3 confirms that there is negligible difference in the results from the two schemes.

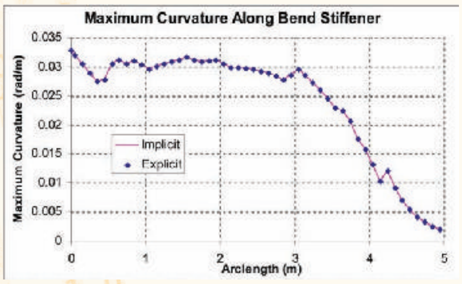


Figure 3: Bend Stiffener Principal Results

Compressive Wave Results

Compressive waves involve a rapid application of compression and curvature, often with the line then snatching straight. These waves can also travel up and down the line, reflecting at the ends. They are generally considered unacceptable and are a 'hot topic' in the industry at the moment. A standard case was run with both explicit and implicit routines and both capture the compressive waves. However, the extremes reported do differ - see results in Figure 4 (note: for the implicit scheme the x-axis now shows the min time step used during the simulation).

OrcaFlex allows the hydrodynamic loads to be computed at time steps which, for computational efficiency, can normally be much larger (30x by default) than the structural time step. However, for compressive wave cases, the rapidly changing configuration requires more regular updates of the hydrodynamic loads. Consequently, a smaller than default hydrodynamic time step is required - here the structural and hydrodynamic calculations both use same time step.

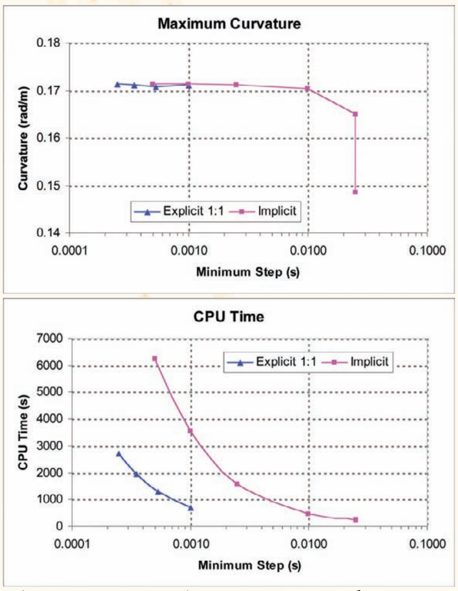


Figure 4: Compressive Wave Key Results

The implicit results show a much greater divergence at large timesteps, with the curvature results less severe than reported by the explicit scheme. At smaller timesteps the implicit results become stable and align with the stable explicit results. In this compressive wave example the behaviour we are trying to capture is at a period of about 0.3s. Using the default setting, explicit gave 244 steps per cycle while implicit gave only 10 steps. This is on the low side to capture the cycle accurately.

This study indicates that a sensitivity study on timestep is always advisable. Here an implicit time step of 0.01s is the largest we can use without significant loss in accuracy. This gives a runtime similar to the accurate explicit, even though the implicit step is about 10x bigger.

Very High Frequency: Snatch Loads

Here we have put together a simple installation case where snatch loading has been deliberately created. The model used is a lumped payload suspended from a vessel by a wire.

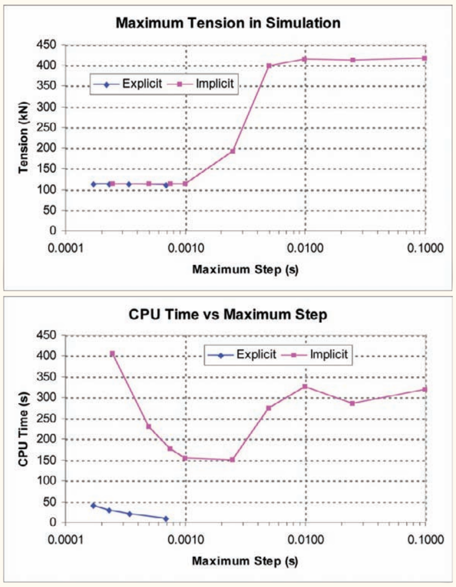


Figure 5: Snatch Load Key Results

In this example the implicit scheme takes longer to run than the explicit. But why? With a large Δt_{max}, the iteration count per time step is repeatedly reaching the iteration limit as it struggles to follow the high frequency variations in the system. This is also reflected in the amount of variation in timestep, all resulting in long runtimes. With a reduced Δt_{max}, the iteration count is lower, there is little variation in the timestep and the simulation is consequently faster. For even smaller Δt_{max} values, the CPU time starts to rise again. The routine can't take advantage of points in the wave cycle where larger timesteps could be used, resulting in longer runtimes.

As for accuracy, both explicit and implicit capture the occurrence of snatch behaviour. With the explicit scheme, reducing the time step makes negligible difference to the maximum tension observed - it just takes longer to run!

However, with the implicit scheme there is a wide variation in maximum tension reported. Smaller Δt_{max} values gives results which closely match those from the explicit scheme, however, they take longer to run. For the same accuracy we can see that explicit is at least 15x faster than implicit.

The minimum timestep used is reasonably constant in all the implicit cases, about 5×10^{-5}s. But when implicit is allowed to create larger timesteps it is more likely to filter higher frequency responses and diverge from the explicit results.

The point of this type of analysis is to identify if snatch loading occurs and both integration schemes do this. However if you also want to model post-snatch behaviour then you will need to carry out some sensitivity studies on timestep. It's worth noting that a 'quick' sensitivity study for the implicit scheme might show no results variation unless the time step is considerably reduced. This case clearly shows the advantage of using an explicit time integration scheme in sensitivity studies.

Conclusion

The new variable step implicit time integration scheme is available alongside the existing explicit integrator in OrcaFlex. This is a very powerful combination, and together with the robustness of the OrcaFlex model, it offers the user maximum choice and facilities for performing dynamic analysis - something not avaliable from other software packages in OrcaFlex's peer group.

Deepwater SCR comparison with Flexcom

As part of our ongoing efforts to demonstrate the validity, accuracy and robustness of the OrcaFlex model, we have recently compiled a short, but comprehensive, list of validation cases:

a) Deepwater SCR comparison with Flexcom.

b) OMAE 2006: Comparison for a simple hanging catenary.

c) Cantilever torsion-bending coupling (Reismann).

d) OMAE 2005: Static bending in touchdown.

e) A selection of 'theoretical' cases including comparisons with catenary equations including stretch, natural frequencies of a beam and cantilever beam deflection.

We intend to publish all these on our website before long. In the meantime, they are available on request (note: the results from both (c) and (d) have appeared in previous Orcina newsletters).

However, in this article we present the details from the recent work comparing Flexcom and OrcaFlex for the case of a deepwater SCR. **Agreement was excellent throughout, and clearly demonstrates that exactly the same results are obtained from both OrcaFlex and Flexcom.**

Background

An independent consultant set up and ran Flexcom and OrcaFlex models for an SCR supported by a semisub host vessel, for typical deepwater Gulf of Mexico or West Africa conditions. In particular a very heavy wall thickness pipe was used and a higher than normal seabed stiffness was assumed in order to try and induce chatter and model instability. Typical extreme and fatigue waves were analysed both as regular and irregular sea states.

Excellent agreement between the two programs was found throughout. Here we extract and show comparisons of the static results and maximum dynamic bend moment for a regular wave, and also report the sensitivity of results to element length.

Input Data

The GoM case is chosen for presentation here. A 12in SCR is supported by a semisub host vessel in 1800m (6000ft) of water. The SCR has a 1 inch wall thickness.

The OrcaFlex and Flexcom models both used element lengths of 5m, apart from a 300m section around the TDP where 1m elements were used.

The comparison considered some cases with a high seabed stiffness value of 2400kN/m/m and other cases with a lower seabed stiffness value of 240kN/m/m. (These values are quoted in Flexcom units – the equivalent OrcaFlex values are 7792kN/m/m2 and 779.2kN/m/m2 respectively.)

Results Comparison

The independent consultants concluded that: "The models running in both Flexcom and OrcaFlex ran stably throughout the tests. Initial benchmarks showed the programs produced very similar engineering results well within any accuracy tolerance expected."

This agreement is illustrated by the following comparisons of static and dynamic results:

	OrcaFlex	Flexcom
Effective Tension at End Connection (kN)	697.0	697.6
Effective Tension at Hang-off (kN)	3340.5	3345.5
Moment at Touchdown Point (kNm)	104.9	105.0
Shear at Touchdown Point (kN)	9.24	10.2
Touchdown Element No.	217/218	218/219

Table 2: Comparison of Static Results

Comparisons of both regular and irregular wave cases were performed with excellent agreement in all cases. Figure 1 shows the maximum bend moment plotted along the length of the riser for a linear regular wave with height 20m and period 15s. Note that the curves from Flexcom and OrcaFlex are both plotted on the same graph and are almost indistinguishable.

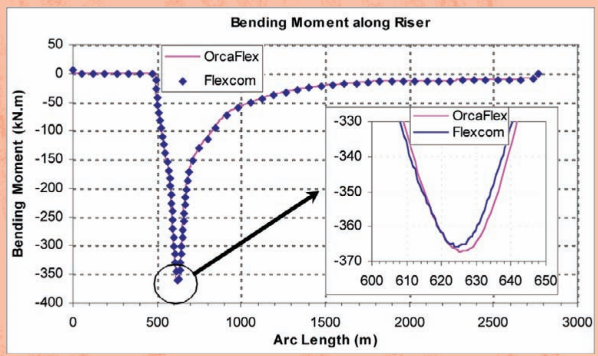


Figure 1: Comparison of Dynamic Bend Moment Results

The inset shows an enlarged view of the 'peak' results. Again, for engineering purposes, the results are identical, although we note the smoother variation of the bend moment curve from OrcaFlex.

Effect of Element Length on Accuracy

The independent consultants also ran OrcaFlex and Flexcom using different element lengths in the touchdown section of the riser, in order to study the effect of element length on the results - see Figure 2. They concluded: "Sensitivity on element length was performed for the regular extreme wave, using 2m, 1m, 0.5m and 0.25m elements at the touch-down point. The results showed that the moments predicted by OrcaFlex produces at least as good results for the same element sizes as Flexcom."

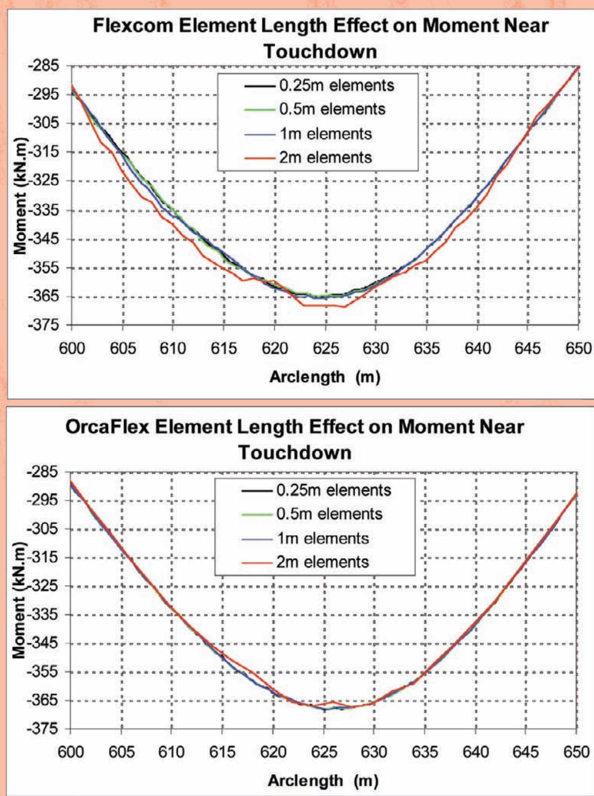


Figure 2: Effect of Element Length on Bend Moment near Touchdown

It is clear that for the same element size, OrcaFlex and Flexcom produce the same results, to well within engineering tolerance. However, the graphs also show more irregularity in the Flexcom results compared to OrcaFlex results for the longer element lengths, although, as expected, this variability decreases for both programs as element size reduces.

Conclusions

An independent consultant modelled a typical Gulf of Mexico deepwater SCR in both Flexcom and OrcaFlex. Excellent agreement between the results from both programs was achieved for statics, regular wave dynamics and irregular wave dynamics. It was also found that using the same element lengths in both OrcaFlex and Flexcom produced the same results - to well within any engineering tolerance.

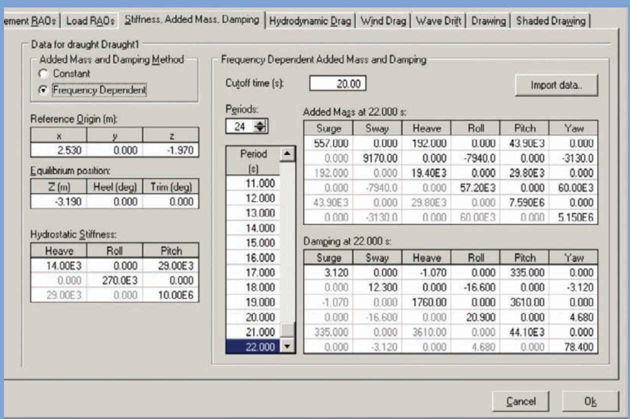
Continued from page 1

Fully Coupled Vessels and Convolution

Frequency dependent or not frequency dependent - no longer a question….

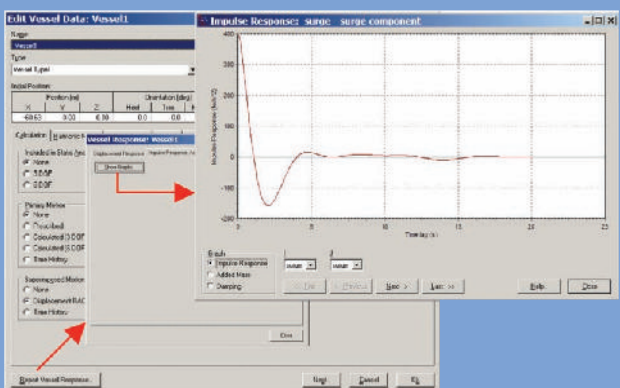
Displacement RAOs have been in use in OrcaFlex for many years and will be very familiar to most users. The optional facility to use Load RAOs was introduced to OrcaFlex in version 8.5 (June 2004). In that implementation, the added mass and damping terms (AM&D) are taken as constant (frequency independent) values. Of course AM&D, as part of the hydrodynamic radiation solution, are inherently frequency dependent. Consequently the above limitation involved the user in making judgements about the likely system response frequency, and using AM&D matrices for that frequency value.

A better approach is to enter the frequency dependent data and let OrcaFlex sort out the rest. However, this means that the impulse response function (IRF) has to be determined, and applied at each time step using a convolution integral over time. This improved approach is now incorporated into OrcaFlex version 9.0, as shown in the screenshot.



Clearly this is more data to enter, but (some!) help is at hand. We have provided facilities which automatically import this data from AQWA and WAMIT. Now that we are using the IRF, we also need to say how far back in time we want the convolution integration to be performed – hence the ‘Cutoff time’ data item.

On the vessel response form there are facilities for plotting the IRF as a function of time and the AM&D as a function of frequency. With the added mass we also plot the infinite frequency added mass value – if the data does not tend towards this value it indicates that there might be a problem with the data – either errors in the hydrodynamic model or perhaps not enough frequencies to sufficiently model the frequency dependence.



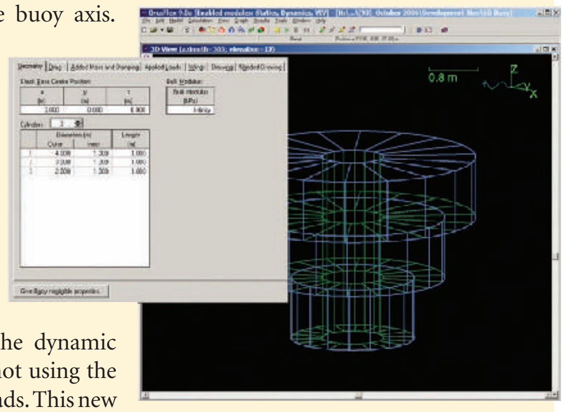
Above a sensible minimum value for the Cutoff time, the results are unaffected. Also Cutoff time does not have a large influence on total simulation time, typically a few percent for times producing accurate results.

The big advantage of this new feature is that it allows multiple load cases to be set up through the pre-processor, with OrcaFlex automatically handling the potentially wide range of multi-frequency responses this might generate.

Hollow Spar Buoys

A long awaited development for those with holes in their buoys…..

With the 6D Spar Buoy option it is now possible to specify not only the OD of the buoy, but also now the ID! So the buoyancy and hydrodynamic forces all account for the instantaneous water level relative to the buoy. Note that the hydrodynamic inertia due the water inside the buoy is only added in normal directions, that is the water is assumed free to move axially through the hole along the buoy axis.



Previously, to account for the ‘hole’, the user had to manually increase the mass or decrease the buoyancy to achieve correct hydrostatics. Either approach then meant that the dynamic calculations were not using the correct dynamic loads. This new feature makes the modelling of hollow cylinders used as ‘floaters’ much more straightforward, avoiding all the previous difficulties.

And lots of other goodies

Too many new features to mention here in detail, but….

Line contact allows for diameter: Contact with the seabed and solids now accounts for line diameter. Essentially contact now occurs at the outer edge of the line, rather than at the centreline as in previous versions. This greatly simplifies model preparation for arches, guide tubes etc. since the true physical geometries can now be specified in the solid data.

Seabed Stability: Lift & drag vs. height above seabed: Lift and drag coefficients can now be defined as a function of height above the seabed. Now the vertical stability of a grounded pipeline subject to various flow conditions can be directly assessed in OrcaFlex.

Torsethaugen spectrum added: This is a double peaked spectrum (like the Ochi-Hubble) but better suited to typical North Sea conditions. It allows representation of wind sea and swell occurring simultaneously.

Vessel prescribed motion at headings other than Vessel x: Prescribed motion has long allowed motion in the direction of the Vessel x axis. Several clients found that they wanted to be able to move their vessel in a direction other than Vessel x. This new data item allows this, with the direction of motion set relative to either the Vessel x or the Global Axes system.

All Objects Data Form superseding the All Lines Data Form: It’s great to report the continued growth of this data form (remember when it started as line end connection data?) Now it allows all the OrcaFlex objects in the model to be viewed and / or edited on a single form. Particularly powerful if you remember the copy+paste down (CTRL+d) and up (CTRL+u). What next for this form…?

In the Next Orcina Newsletter

Well, there’s been so much in the v9.0a release, that it’s a little hard to think as far ahead as the next newsletter. However, we have taken the slightly unusual step of publishing on our website a longer list of developments which we plan to try and tackle over the next 12 to 18 months (see www.orcina.com/Support/OrcaFlex).

Notwithstanding, our development plans continue apace, with implementation of 3D seabeds, workspace persistence and friction on solids all well advanced – so we hope to report on these next time. We’ll also provide an update on the validation documentation for readers to peruse.

News in *Short...*

User Group Meetings and Training


OrcaFlex UGM in full swing

As reported in the last newsletter we have considerably expanded the number of User Group Meetings (UGMs) we hold annually. We now visit Aberdeen, Rio, Houston, Perth, Paris and Stavanger. At the time of writing we have completed the first five of the UGMs for this year. The meetings have been very useful to us in providing feedback and comments and, we hope, to those who have kindly taken the time to attend.

Each User Group Meeting has an associated 2 day Open Training course. For the first three meetings the training courses have been fully booked and we have been in the unfortunate position of having to turn people away. Our many apologies to those of you we couldn't accommodate. Please keep an eye on our website (www.orcina.com/Support/SoftwareTraining) for the latest courses and dates. Also remember that in addition to the above Open Training courses, we conduct many client specific courses throughout the year – arranged at mutual convenience. Please contact us if this is of interest.

Orcina Under Snow

Given that we are located in one of the more mountainous parts of England (just South of the Lake District), it seems a bit surprising that we are reporting record snow levels last winter, especially as we have been through a very warm summer and mild Autumn in the meantime!

However we don't generally get much snowfall here because of our proximity to the coast, but every now and again we do!

New Member of Staff

Colin Lewis joined Orcina in October 2006, to work with the consultancy team. Colin comes fresh from a degree in Theoretical Physics, and then a Masters in Mathematics with Modern Applications; both from the University of York. The Masters course included a four month internship with Shell, validating the results of numerical simulation software. His initial training period at Orcina involved a dip in the 'deep end', doing VIV analysis within two weeks of arrival!

Orcina - out and about

Exhibitions, User Group Meetings and Training Courses:

For all these events please see the Orcina website (www.orcina.com) for the most up to date information.

Orcina will be present at the following Conferences / Exhibitions during 2007:

- **OTC (www.otcnet.org), Houston, 30th April to 3rd May 2007.**
- **OMAE (www.ooae.org/omae/omaeconf.html), San Diego, 10th to 15th June 2007.**
- **Oceans (www.oceans07ieeeaberdeen.org), Aberdeen, 18th to 21st June 2007.**
- **Offshore Europe (www.oe2007.co.uk), Aberdeen, 4th to 7th September 2007.**

We will also be holding OrcaFlex User Group Meetings as usual during the Autumn of 2007, with a schedule yet to be finalised. As per the usual format we will also hold OrcaFlex Open Training sessions immediately following each of the UGMs.

We will update these details in the next Newsletter, but for the latest information please look on our website, or contact us if you just want to ask directly!

Did You *Know...*

a) …that the Profile button for hysteretic bending stiffness now shows the complete hysteresis loop.

b) …right clicking on a time history gives several options – one being Spectral Density. This shows the frequency content of the response and can be very useful - particularly for more complicated models, for VIV analysis and other models where multi-frequency response occurs.

c) …in the shaded graphics view (CTRL+G), the node axes can now also be toggled on and off using CTRL+ALT+Y.

d) …random wave seeds can now be either set automatically and repeatedly by OrcaFlex, or completely user-controlled.

e) …6D Buoy centre of mass can now be specified. Previously the CoM was always located at the buoy axis origin, but this new feature allows complete freedom to choose where the origin is.

f) …shaded drawing drag rotate can now rotate about viewer position if ALT key is held down as the same time as the CTRL key.

g) …on the results form a 'results filter' has now been added for range graph results. This was previously only available for time history results.

h) …outer time step recommendations for explicit integrator can now be controlled by the user (eg, the 30 times inner time step and 1/40th of wave period recommendations can now be customised).

i) …replay start and finish times can now be '~' which mean 'simulation start time' and 'simulation finish time'.

j) …AVI files can now have frame details (eg, time, multiple file replay frame title) included by using the check box on the Export Video dialog box.

k) …that since 8.5 you can get sea surface clearances. This reports vertical clearance from node centre to sea surface. Negative values mean that the node is getting wet!

l) …Use Calculated Positions can now use the positions from the active replay time.

m) …we've added new units tef (tonnes-force) and kgf (kilograms-force) to help avoid any units confusions.

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