Orcina *Newsletter*

OrcaFlex 8.0 Arrives...

And we haven't even issued the newsletter about version 7.5 yet. Oh dear... So here is a quick skim through some of the important new features since 7.4

More and Better Examples

We have updated and greatly expanded the example files supplied with OrcaFlex. The CD now contains over 40 examples organised into groups by application (risers, moorings, floating hoses, etc.) and cross-referenced in the Help file by particular technical issues illustrated (sloping seabed, use of the Line Types Wizard, line end orientations, and so on). Each example has an explanatory text in the Help file. Do have a look through them and if you have ideas for additional examples, let us know. Bear in mind that the examples are chosen to illustrate modelling techniques we don't vouch for the engineering soundness of any of the systems!

Even More Fatigued.....

The fatigue analysis facility in OrcaFlex has now been extended to include the rainflow method for use with random sea results, and users can now define their own S-N curve as a look-up table.

Fatigue analysis based on the rainflow method of cycle counting is generally seen as the most accurate method available, but is a good deal more time consuming to perform. You need to run quite long random sea runs and the cycle counting and damage summation itself can take quite some time. But if it's accuracy you want... For more detail see the OrcaFlex Help file.
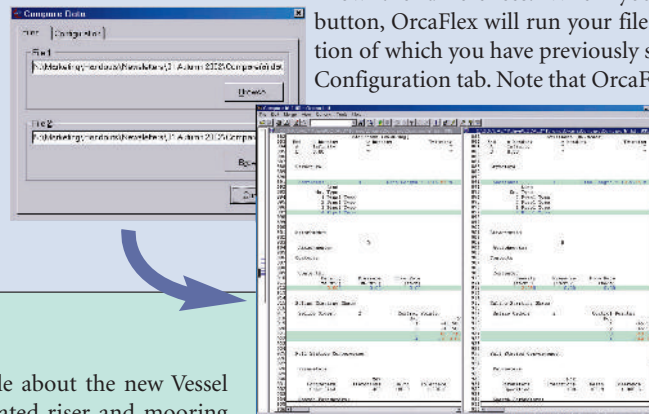
Variable Data

It has been traditional to include data such as the drag coefficient as a constant throughout a simulation. This despite it being known that the local flow conditions (ie Reynolds Number, Re) may vary enough that the drag coefficient also changes. To address this we have spent time re-organising the software to allow the user the facility to specify drag coefficient as a function of Re. Therefore you simply stick the curve into OrcaFlex and let the program determine what drag coefficient should be used as the simulation proceeds. Now we can all avoid those 'awkward' arguments about which (ie for what Re) drag coefficient should be used!
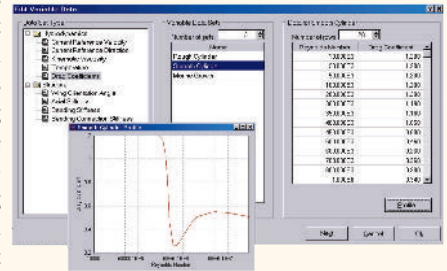
Other data which can be varied in this way now include: Axial Stiffness (for man-made fibres, eg polyester ropes), bending stiffness (for bend limiters), connection stiffness, as well as the drag coefficients mentioned above. Upcoming data which can be implemented in this way includes: Current reference velocity and direction (brilliant for modelling loop currents) and wing orientation angle. The latter is particularly useful to model a towed object which varies its depth by changes in wing angle of attack.

Compare Data

Have you ever made so many changes to an OrcaFlex datafile that you can't remember exactly which data you have changed? We have, and it can lead to a lot of painstaking searching through two datafiles to see whats changed. Thankfully thats all in the past now. In the File drop down menu there is a 'Compare Data' facility. This opens a dialogue box which allows you to select two OrcaFlex datafiles (not necessarily in the same directory) for which you want to know the differences. When you click on the 'Compare' button, OrcaFlex will run your file compare utility - the location of which you have previously set up in the Compare Data Configuration tab. Note that OrcaFlex does not ship with a file compare program, but a little searching on the web will turn up many freeware programs, or speak to your IT colleague.

Free Ships!

Well sort of! The last newsletter had an article about the new Vessel Slow Drift facility emphasising use for integrated riser and mooring analysis. The facility is now available on general release, and we've found more uses for it.

Vessels now have two components of motion, Primary and Superimposed. The primary motion may be a prescribed movement in the horizontal plane (move forward at a given speed; turn at a given rate) or OrcaFlex will calculate the motion resulting from wind, current and wave- drift forces plus any other external forces we sometimes refer to this as the Slow Drift option. Motions at wave frequency based on RAOs can then be superimposed or not as you choose.

The Calculated Primary Motion option opens a range of possibilities. If you specify an Applied Force in the vessel x direction and set Primary Motion to Calculated, the force will drive the vessel forward. A recent job involved towing a pipe bundle from a lead tug, with a trailing tug providing a back tension. Using the new facilities, we were able to model both tugs as free bodies with propeller thrust represented as an applied force on each. OrcaFlex then modelled the motion of both tugs plus the bundle. Just like the real world!

Orcina

The New...

News in *Short...*

New Staff
Orcina has recently expanded with the addition of two more members of staff. David Binks has joined the software development group. Previously with BNFL in Cumbria, David has been leading the development and implementation of the new VIV module. The consultancy side has also been strengthened by the addition of Dr Sarah Smith. Sarah recently completed her PhD and joins us from CRP, and has kicked off with many towed bundle analyses!

New Agent in Houston
We have expanded our representation in Houston by appointing another Orcina agent. MMI Engineering, and specifically Paul Jacob (email: pjacob@mmiengineering.com), have joined with Bil Stewart of STA Inc, to market Orcina and Orcina software products in the US.

Statics-only version available
There is now a statics-only version of OrcaFlex available. It retains the full user interface of the dynamic version of OrcaFlex, meaning that model building, results inspection etc is just as easy as before. However, those data items relating to performing a time domain dynamics analysis are greyed out and cannot be used. This means, however, that the normal full range of OrcaFlex statics are available, including Multiple Statics (for calculating mooring system load-excursion curves), and the new Modal Analysis facility for determining the mode shapes and frequencies of a line. The statics-only version comes in at a much reduced price - please contact us for more details.

New Marketing Role
Dave Thomas, who joined the company nearly three years ago, has taken on the lead in the marketing Orcina, our software products and consultancy services. In addition to spearheading the marketing effort, Dave will remain technically involved by handling client technical support and project work.

OrcaFlex Manual in pdf Format on CD
We continue to send out hardcopy manuals with initial purchase or lease of our software. However, in the interest of being environmentally friendly (and to avoid massive bulk mailings), we don't generally send out hardcopy manuals when we issue the twice yearly upgrades to OrcaFlex. Of course the on-line context sensitive help file is always up to date, however, for those wanting hardcopy by their side, we have started to include an electronic copy of the up to date manual on the upgrade CD (in pdf format). Users can then print this out at their discretion.

The New VIV Toolbox

OK, so it's finally here! The new Orcina VIV toolbox sees the light of day outside of the company. For those of you who haven't followed the development of this module, this article outlines the main features and facilities.

In summary, the VIV toolbox offers the OrcaFlex user the following:

- Detailed interface to the frequency domain VIV analysis software called **VIVA**;
- Mode file export to the other frequency domain VIV analysis package called **SHEAR7**;
- Time domain VIV analysis using **Wake Oscillator Models**;
- Time domain analysis of VIV using **Vortex Tracking**.

...and all of this couched within the user friendly interface that OrcaFlex prides itself on. The advantages of this level of functionality will be self evident to those VIV analysts out there, but to re-cap on some of the key benefits as we see it, the user gets:

- Reliable and efficient model building using the tried and tested OrcaFlex interactive user interface;
- Quality assured implementation of time domain models, ie making sure that they do what the published models state they will do!
- Reliable, tested and fully documented interfaces to both SHEAR7 and VIVA;
- Consistent modelling for all computation methods ie one structural model from OrcaFlex fits all!!

So, how has all this functionality been implemented in OrcaFlex? Well, it has to be said we think that the user interface looks rather un-assuming! In fact, the VIV modelling details are contained on a new tab on the Line Data Form....Details of each of these are as follows:
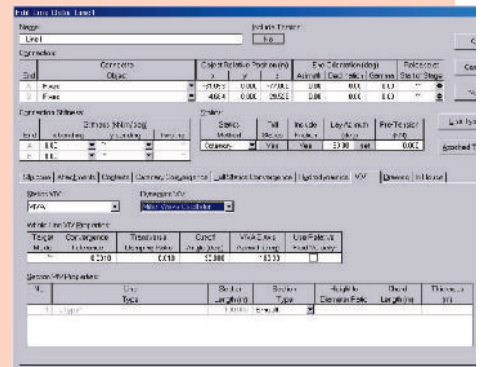
VIVA: Orcina participated in the recent VIVARRAY JIP, supplying in kind a fully validated software interface between OrcaFlex and a new version of MIT's VIVA program. Once your structural model has been built in OrcaFlex, then VIVA can be called either at the end of the statics calculation, and/or during the dynamic simulation. Results from VIVA include the amplitudes of vibration as well as mean effective drag coefficients. The neat thing with this interface is that the VIVA calculated drag coefficients can be au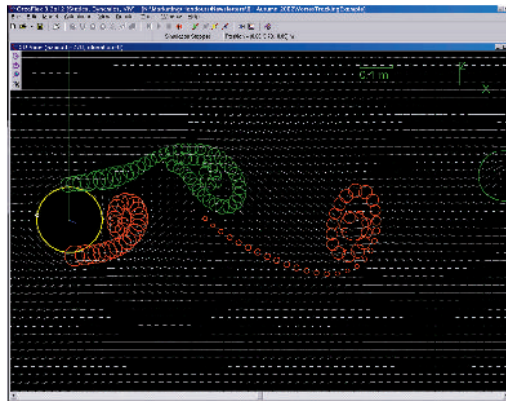tomatically imported into OrcaFlex. This can be done once - at the end of the statics - or at intervals during the OrcaFlex dynamic simulation. In this case OrcaFlex makes user-defined periodic calls to VIVA which repeats the VIV calculation for the instantaneous riser configuration. The VIV enhanced drag coefficient distribution is then read back into OrcaFlex which continues with the analysis.

As well as VIVA, the other leading software for VIV analysis is called **SHEAR7**. Not wanting all our eggs in one basket, we have also developed links with SHEAR7, with co-operation of the author, Prof. Vandiver at MIT. SHEAR7 users regularly told us that the hard bit in preparing data for input to SHEAR7 was the generation of the *.mds file, for configurations other than tensioned risers. OrcaFlex now generates the *.mds file directly from within the OrcaFlex modal analysis form. We hope that this facility will make it much easier to use SHEAR7. In the longer term, we hope to implement a much closer interface, in which SHEAR7 can be run directly from within OrcaFlex.
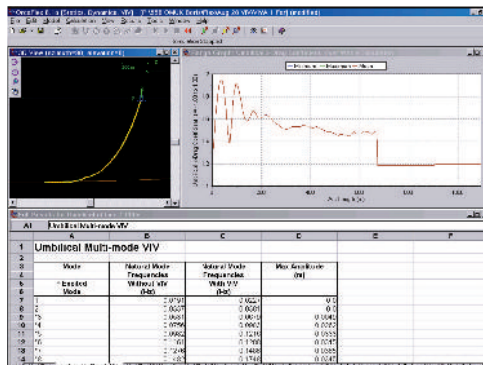
Wake Oscillator Models: Crikey - what are these? Essentially a Wake Oscillator introduces a variable forcing function on the riser with a frequency and amplitude consistent with the VIV phenomena. The analysis of time domain methods has been undertaken in co-operation with the Industrial Mathematics Group at Lancaster University, and the first part of their work focused on some of the many wake-oscillator models developed over the last twenty years. Their detailed analysis has shown certain difficulties with many models, but has pointed up a couple of models worthy of further investigation. We have already implemented the most successful of these (the so-called Milan model) and have applied it to a variety of cases, and are presently working on the implementation of the second of these, the Iwan and Blevins model.

The second phase of the investigation into time domain VIV concerns **Vortex Tracking**. Here, the model introduces a degree of physical realism to the model which is absent from the wake oscillator methods. Our implementation (an example of which is shown below) is based on published work by Sarpkaya and Schoaff. Work to date shows considerable promise, and we expect it to offer a practical analysis technique which gives much of the realism of Computational Fluid Dynamics (CFD) techniques without the associated extravagant runtimes.

The following picture shows the implementation of the Vortex Tracking method in OrcaFlex. Note that the inflow velocity vectors are shown (in grey) and the shed vorticity is alternating red and green swirls coming from the downstream side of the cylinder. You can also see how the vorticity is deemed to have collapsed to a single point vortex at a pre-determined number of cylinder diameters downstream of the cylinder. If you look closely you can also see a small white circle on the circumference of the yellow cylinder. This is the

stagnation point, and can be seen to oscillate about the leading edge of the cylinder as the vortices induce motion in the cylinder.

implementation of the Vortex Tracking method in OrcaFlex

As far as testing of the VIV toolbox is concerned, we have fully tested the interfaces to SHEAR7 and VIVA in co-operation with the vendors. This confirms that the Orcina interface exchanges data with these software in precisely the manner required.

We have also completed testing on the implementation of the Milan WOM. This confirms that the Orcina implementation produces results in agreement with those published in the literature.

The VIV ToolBox Launch!

The initial launch of the VIV toolbox is occurring in two phases. In the first release (August 2002), the user gets the interfaces to VIVA and SHEAR7, plus the time domain Milan Wake-Oscillator model and the Vortex Tracking model (on beta test release). In the second release (scheduled for November 2002) we will include the other wake-oscillator model (Iwan and Blevins) and the full release of the Vortex Tracking model. Because the VIV toolbox will have the same high standard of maintenance and ongoing development which all our software

receive, we already have a list of things we want to tackle in the near future!

Because vortex-induced vibration is a specialised subject, and not required by all OrcaFlex users, we have issued these facilities in a separate VIV module, sold as an add-on to OrcaFlex. Please contact us for price details, but note that purchase of the OrcaFlex VIV module does not include supply of VIVA or SHEAR7 - these have to be purchased separately from those software vendors.

Did You *Know...*

...if you have a model with lots of objects, then sometime it can be difficult to see what is going on - especially if other objects are obscuring the view. Try selecting the 'obscuring' objects in the Model Browser, then right click and apply the 'Hide' menu item. The object then disappears from the 3D view (but it is of course still in the model!). If an object is already hidden, then selecting and right clicking allows you to 'Show' the object.

...a North indicator can be created in your view by adding a 2nd vessel with no motions. Set Primary and Superimposed Motion as None and modify the drawing to make the symbol you want.

...have you ever lost a modelling object? We have a new 'locate' feature to help you find out where it is. Right click on the 'lost object' in the model browser and select the 'Locate' option - your object either flashes for you in the 3D view, or OrcaFlex tells you that it is not in the 3D view and would offer you to like to have the 3D view changed to see it.

...you can change line type limits, stress diameters, allowable stress and stress factors after a dynamic run. These are post-processed values so a repeat dynamic run is not required.

...previously OrcaFlex could not handle simulation files larger than 2Gb. This limit has now been removed.

...all results now come date stamped with the date and time of the simulation file. Previously the data stamp showed the date and time of that particular OrcaFlex session.

...for those of you really keen to know the nitty gritty of what is happening, there is now an option to use double-precision logging! However, only use it if you really need to (mostly not) 'cos it doubles the size of the simulation file!
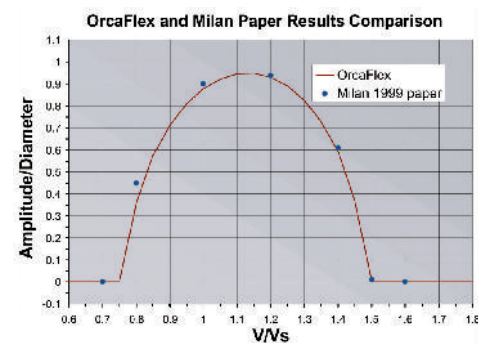
...you can now select multiple range and offset graph variables from the results form, rather than having to do them one at a time. You can also optionally keep the results form displayed (right click on the results form) until you explicitly close it - very useful to select multiple results for more than one object.

Orcina News

Modal Analysis for Lines

OrcaFlex has always been a time-domain program, but taking a frequency domain view can be valuable. As a first step in that direction we now offer a modal analysis for any individual line. Run a static analysis, then select Modal Analysis from the Results menu. OrcaFlex reports the period and normalised mode shape for each mode.

The results can be viewed as shown to the right, and tables of mode shape and frequency can be used. Note 'VIV' tab in the pictures - this allows export of the mode shapes to SHEAR7 (but only if the OrcaFlex VIV licence has been purchased or leased).
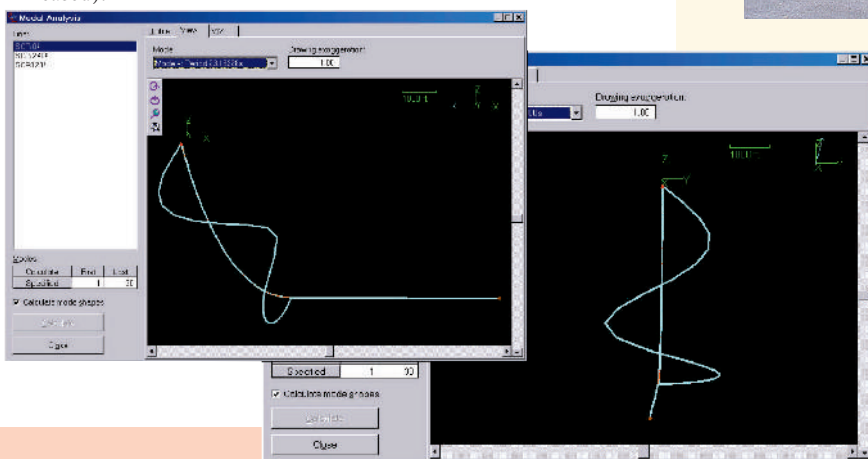
No Rust On My Bike

By popular demand (well, at least two!), here is the promised photo of the Orcina bicycle shed. The roof is composed of Burlington Strongs, which pleases the style police and also supports the local quarrying industry. Those of you who are qualified roofers and slaters will know that 'Strongs' = 'Thick and Heavies', so the whole structure has massive framing to prevent the roof from crushing the bicycles. Another example of over- specification leading to runaway project costs...

In the Spring Issue

• **What is OrcaLay?..........We will feature this stand alone tool for planning and optimising installation procedures pipelines & umbilicals in some depth (forgive the pun!!). The article will cover the three installation stages and how the constraints are included in this easy to use program**

• **News and your views on the VIV toolbox, & the latest software developments.**

Coming Spring 2003

Exhibitions

Orcina will be present at the following conferences / exhibitions:

- **Deep Offshore Technology (New Orleans, November)**
- **Offshore Pipeline Technology (Amsterdam, February)**

Hope To See You There!

Orcina