Orcina Newsletter
www.orcina.com
Autumn 2008

OrcaFlex 9.2...
...yet more speed and even more features!

OrcaFlex v9.2 was released in August 2008 and it is yet another upgrade rich in new features. A release is also a time for us to take stock, note what has been achieved and to prioritise what is yet to be done. We are delighted that in the 2 years since the OrcaFlex implicit integrator arrived (OrcaFlex v9.0, Sept-06) several clients have adopted OrcaFlex as their main analysis tool. We take this as a vote of confidence in OrcaFlex, our highly active development programme and the support that we offer. This only encourages us to continue the efforts we make on all these fronts.

Released in OrcaFlex v9.2 are several major features, notably several algorithms for performing **Wake Interference / Shielding** and a fully **Non-Linear Hysteretic Soils Model**. This newsletter also reports on further improvements making OrcaFlex faster and more robust, the advent of **Wave Spreading, Multi-threaded Batch calculations** and **Bend Stiffener / Tapered Stress Joint** modelling. We also give space to a detailed discussion of **multi-threaded Fatigue calculations** and how some of the new features make this much more straightforward (note: multi-threading comes as standard in OrcaFlex – there are no hidden costs with this functionality!).

Also, we have expanded the newsletter to include an **OrcaFlex Applications** page. Here descriptions are provided of some interesting models that our clients, agents and Orcina have seen or have been involved with. We hope this will give an insight into the wider applications for OrcaFlex, but also into different modelling approaches. We've also added a **page for our Agents**. They form a vital part of our activity in supporting us - most have been good friends for many years, and we thought it would be helpful to give their activity a little airtime.

As ever we hope that we achieve a useful balance in these newsletters. We always welcome suggestions for improvements and future content so please do drop us a line.

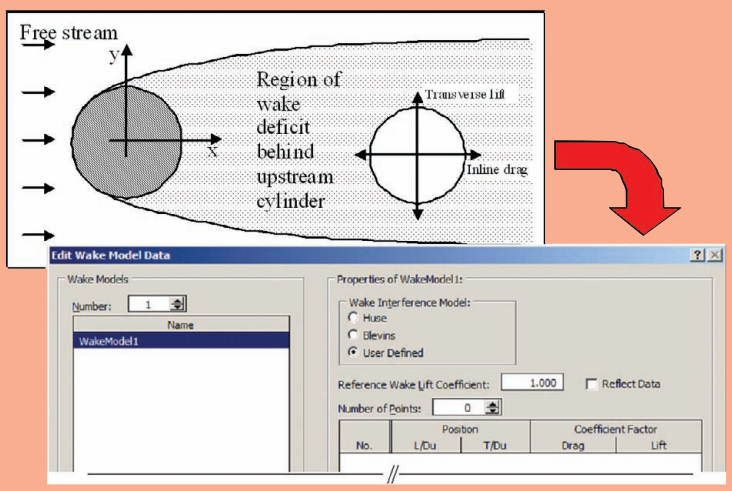
In This Month's Newsletter

WAKE INTERFERENCE / SHIELDING

The introduction of the Huse, Blevins and User Specified options for modelling wake interference is a significant advance in OrcaFlex's technical capabilities...

The behaviour of a downstream cylinder in the wake of an upstream cylinder is a major source of uncertainty when predicting the global performance of closely separated lines. Traditionally it's assumed the lines do not modify the fluid flow – hence both the upstream and downstream cylinders see the same inflow conditions (ie, they are hydrodynamically uncoupled).

However, as line separation decreases, it's more important to quantify the hydrodynamic coupling between adjacent lines. The issue is not just the wake itself or the resulting downstream cylinder motion. Rather, it is of concern if closely spaced lines exhibit relative motions that might produce contact between them. Assessing this requires a reasonable model for the wake behind a cylinder (see picture).



To be a tractable part of the design process, it is necessary to employ empirical methods. In v9.2 we have implemented:

- **Huse Model:** This empirical model was proposed by Huse in 1993. It models the downstream velocity reduction and hence drag reduction, but does not give any wake lift force.
- **Blevins Model:** In this empirical model both the velocity (and hence drag) reduction and wake lift force are modelled. The lift force tends to draw the downstream cylinder into the centre of the wake. The model is described in much more detail in 'Blevins R D, 2005. Forces on and Stability of a Cylinder in a Wake. J. OMAE, 127, 39-45.'
- **User Specified Model:** Here drag and lift coefficient factors are defined for a grid covering the downstream wake region. These data would typically come from experiments.

All these models are 'steady state' models of the wake, ie there is no attempt to model the transient nature of wake behaviour.

They aim to reproduce the characteristic behaviour of one line in the wake of another:

- **Drag reduction:** The closer the lines are to each other the greater the drag reduction, and
- **Lift:** Acts to draw a downstream line back towards the centre of the wake, where, of course, the drag reduction is the greatest!

The in-line and transverse position of the downstream line relative to the upstream line is known at each time step as a normal outcome of a time domain simulation. Using the relative positions we can use the wake models to determine the resulting change in drag and lift coefficients on the downstream riser. These new data are then used for the next step.

One difficulty implementing this feature was that all the above wake models are 2D models that need generalising to work 'sensibly' in 3D. This has been one of the major aspects of this development and we believe this gives OrcaFlex a unique capability in its peer group. More details are given in 'Wu M, Saint-Marcoux J-F, Blevins R D, Quiggin P P, 2008. Paper No. ISOPE-2008-MWU10. ISOPE Conference 2008, Vancouver, Canada', available on request and on our website (search for 'wake interference').

As ever we hope that this level of functionality is useful and allows the ready assessment of wake interference effects – an area previously not that tractable.

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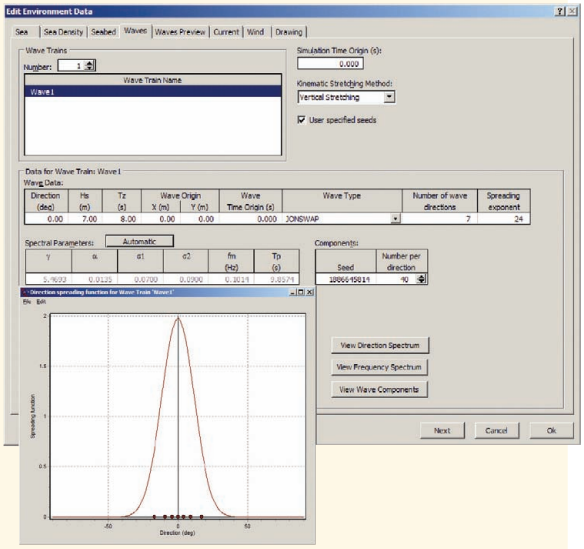
WAVE SPREADING

Spreading the energy around a bit.....

In previous versions of OrcaFlex all the energy of the wave train is focussed precisely at the wave direction. In reality wave spectra often have a distribution of energy around the principal direction of wave propagation. Including this 'wave spreading' effect more realistically can reduce the conservatism inherent in assuming all the energy travels in one direction – ie, that it's not spread.

Previously, wave spreading in OrcaFlex was emulated by generating multiple wave trains (usually with a spreadsheet) which were then manually entered. New in v9.2 is the automation of this approach, allowing the user to set up a spread wave spectrum very much more easily.



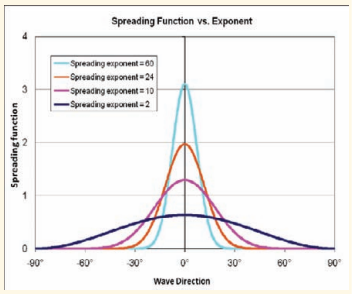
This functionality is implemented on the Waves page of the Environmental Data form through the new data item 'Number of wave directions'. When set to 1 (the default), there is no wave spreading and we have the familiar interface. When set to at a value greater than 1, then we get the following changes to the interface:

- Additional data item: 'Spreading exponent'
- a 'View Direction Spectrum' button, and
- the number of wave components changes to 'Number per direction'.

These are shown in the screenshot, along with a plot of the resulting directional spectrum.

It's the wave spreading exponent which controls the degree of wave spreading– as seen in the graph, although note that the same energy is maintained under each of the curves.

We're relied on spreadsheets to do this for far too long. We hope this extra functionality makes wave spreading much more straightforward to employ.



YET MORE SPEED AND ROBUSTNESS

A continuing tale of ever faster software...

V9.2 continues the significant performance improvements to OrcaFlex since the advent of the additional implicit solver in v9.0 (Sept-06). 9.2 improves the solver in the following ways:

- Default dynamics convergence tolerance has been increased resulting in faster simulations with no discernible loss of accuracy.
- The matrix solvers have been overhauled. These are now more efficient so many simulations will run faster and complex cases with many connections are more robust.

Having made these changes, how does v9.2 perform relative to other peer group software? Using the same SCR case for the previously reported comparison with Flexcom (www.orcina.com/SoftwareProducts/OrcaFlex/Validation; 99/101) we find that, as before, with the same element lengths, **Flexcom** structural results are identical to OrcaFlex, with v9.2 about 5-10 times faster than Flexcom 7.3. Other more limited studies indicate that OrcaFlex is approximately the same speed as **Riflex**. Clearly these relative speeds depend upon model specifics, so it's hard to infer for all models and applications. However, it's evident that OrcaFlex v9.2 now runs very quickly relative to both Flexcom and Riflex.

So far so good! However, other issues also have an impact on cost-effective productivity, and these may often be more significant than direct simulation speed alone:

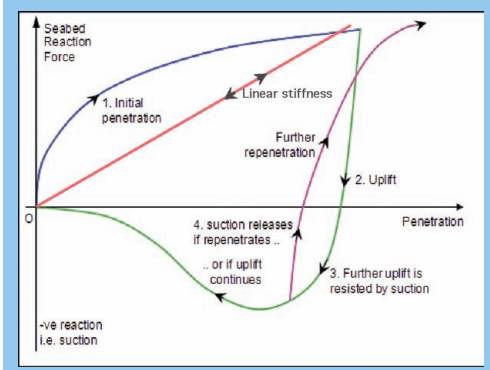
- OrcaFlex comes **multi-threaded as standard** – ie, the licensing terms do not depend on the spec of the machine you're using!
- OrcaFlex **batch and fatigue calculations take full advantage of multi-core hardware** to process load cases in parallel.
- **Distributed OrcaFlex** (available as a free download from our website) enables a collection of networked, OrcaFlex licensed computers to run OrcaFlex jobs, transparently, using spare processor time.
- **OrcaFlex is not modular** so all the additional bits like clearance, contact, modal and fatigue analysis are in one program.
- OrcaFlex has **well developed automation facilities** (pre- and post-processing), avoiding the need for users to write their own automation wrapper. This allows analysis to be efficient and maximises QA.

With computer speed-ups now coming from multi-core / multi-processor architecture, the existing and future developments to OrcaFlex leave users very well placed to take full advantage of this. Any software not thread enabled will struggle to realise the full potential of multi-threading hardware improvements. Future OrcaFlex releases will enable multi-threading for the post-processing spreadsheet and improve multi-threaded performance for single simulations.

It's clear that OrcaFlex is now as quick as other 'fast' codes. When coupled with the best-of-class GUI, multi-threading, single (non-modular) design environment and automation facilities, it must be a clear contender as the tool of choice for all line dynamics applications.

NON-LINEAR HYSTERETIC SEABEDS

For the past year we have been working on a new non-linear hysteretic seabed model. Not being geotechnical experts ourselves, we've been working on this development in conjunction with Professor Mark Randolph at University of Western Australia, a recognised expert in this field



The non-linear seabed was not released with v9.2a as it was not quite ready. However, with final testing and documentation now completed, we are intending to release it as a minor upgrade before the end of 2008. Although we'll probably give it more space in a subsequent newsletter, we thought that it would still be useful to flag it up now.

The model is shown conceptually in the diagram. It is a vertical soil model that allows for trench formation, non-linear penetration resistance, re-penetration and non-linear suction forces. The model takes as input a number of geotechnical data (undrained shear strength at the mudline, shear strength gradient with depth and saturated soil density) and determines the seabed reaction force. For comparison, the existing linear seabed stiffness model is also shown on the diagram.

This represents a major improvement in the soil modelling capability of OrcaFlex and should be of great use, especially to those designing deepwater SCRs.

MULTI-THREADED BATCH

Multi-tasking like never before… There have been several changes to the Batch form over the years, so here's a re-cap of what you can now do with it, including the recent thread enabling in v9.2...

The batch form is found from the Calculation menu (Calculation | Batch Processing). Through the 'Add File..' button (or by drag and drop) the following files can be added:

a) Pre-prepared OrcaFlex data files (*.dat). The Batch form opens the data file, runs the analysis, and saves the simulation (*.sim).

b) Part-run OrcaFlex simulation files (*.sim). The Batch form opens the part-run simulation file, completes the simulation and saves to the same file.

c) Batch script files (*.txt). These text files are typically used to specify a number of variations on a base case (e.g. environmental load cases).

d) Fatigue analysis files (*.ftg). The Batch form runs the fatigue analysis and saves the results to an Excel compatible spreadsheet (*.xls) and to the OrcaFlex fatigue file (*.ftg).

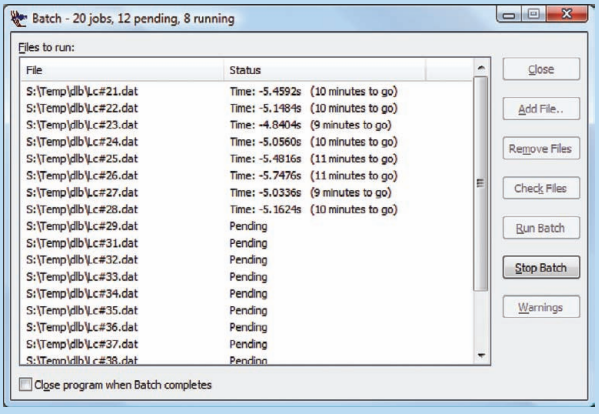
e) OrcaFlex post-processing spreadsheets (*.xls). The Batch form loads the spreadsheet in Excel and processes all the instructions on the Instructions sheet.

Under Tools | Preferences the Batch Auto Save interval can be set so results can be automatically written at the specified interval. This is very useful if simulations might be interrupted as the part-run simulation file can be loaded and continued, rather than having to re-run the whole simulation from scratch.

OK, thus far we have this functionality in v9.1 – so what's new in v9.2? Basically the new bit is that batch processing can make use of any multiple cores that you might have on your machine. So, for example, if you have a quad core machine, then 4 jobs can be run simultaneously – clearly resulting in much greater throughout! However, note that the batch forms processes jobs in a particular order as some of the jobs might depend on others in the list:

1. Batch scripts first (these often write out the data files that are subsequently processed)
2. Any data files or part run simulation files.
3. Fatigue files (may need the simulation files as input)
4. OrcaFlex post-processing spreadsheets (again these may require the simulation files as input)

The new multi-threading capabilities are a great performance



enhancement. Coupled with the very versatile features already within the Batch form, you can crunch through vast amounts of analysis in a robust way.

HOMOGENEOUS PIPE CATEGORY AND BEND STIFFENER / TSJ MODEL GENERATION

New line type category and profiled ODs make it a breeze to model SCRs etc, Bend Stiffeners and Tapered Stress Joints...

Line Type 'Category' and Modelling Homogeneous Pipes

First up is the introduction on the Line Types form of a new data item called 'Category'. This has two options - Homogeneous Pipe and General, differing only in the Line Type data which each requires. The General category allows a fully general specification of line type data; this is exactly the same data presentation as previous versions of OrcaFlex. It's the new Homogeneous Pipe category where there are some differences. Selecting this allows you to set data by Young's Modulus, material density and pipe diameters – making it more straightforward to set data for homogeneous pipes such as SCRs and TTRs.

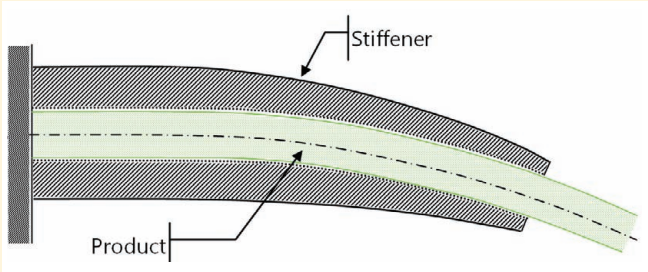
Profiled outer diameter (OD) for Bend Stiffeners and Tapered Stress Joints

The Homogeneous Pipe category allows the OD to be specified as a function of arc length. The program calculates EA, EI, mass etc. which also vary with arc length. This new option opens the way to simpler modelling of bend stiffeners (stiffener) and tapered stress joints (TSJs).

Whilst it has always been possible to include these in OrcaFlex, setting them up was somewhat fiddly and time consuming. OrcaFlex 9.2 makes this much more straightforward and indeed improves the analysis for the stiffener.

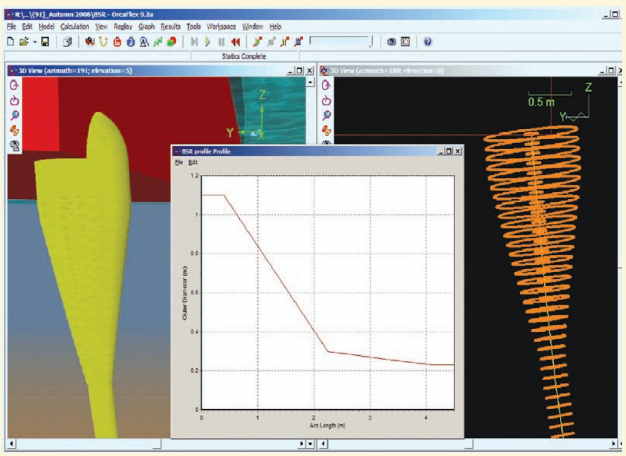
The TSJ is an integral part of a homogeneous pipe. It is simply a machined section with the same ID as the non-tapered pipe but with a profiled OD, placed in-series with the underlying product. 'In-series' is precisely how they are modelled in OrcaFlex: simply by setting a line type with a profiled OD, and attaching this to the appropriate Section of a Line.

By contrast the new approach to modelling stiffeners is slightly different. These are in reality, and in OrcaFlex 9.2, regarded as being in-parallel with the underlying product (see diagram).



In v9.2 we handle this by thinking of the stiffener as an Attachment to the line (see 'Attachments' page on the line data form), with an appropriate attachment point (arclength z=0m in the example above). The product line is then set up as normal on the line data form - by doing this the product line runs through the stiffener. Taking this approach means that we can get results separately for the Stiffener and the product – particularly good for doing the fatigue analysis of the product alone and it also means the product can have non-linear elastic or hysteretic properties.

It's very straightforward to set the stiffener up as an Attachment: Simply create a Homogeneous Pipe line type with a profiled OD to represent the stiffener, and then on the Attachments page (Line Data form), create a stiffener attachment type and use the profiled OD line type just created. A simple stiffener profile is shown in the screenshot



below. (Minor point: the stiffener is only drawn after statics has run – ie, you can't see it in the reset state!)

So there it is! All very straight forward, making it significantly easier and more accurate to model bend stiffeners and TSJs in OrcaFlex. Hope it helps a lot!!

Fatigue Analysis Facilities in OrcaFlex

Here we have taken some space to provide more details about the built-in fatigue analysis features in OrcaFlex. Although this functionality has been in the program for many years now, it's recently undergone a major revision for v9.2. Consequently we thought that this was a good opportunity to explain more about fatigue analysis and the facilities for it in OrcaFlex.

Introduction

A key aspect of much dynamic analysis is the prediction of the response of a structure to extreme loadings - typically 100-year return period wind, waves and current, along with associated vessel offsets. However, the fact that risers, etc, are exposed to non-extreme environments most of the time, also needs to be accounted for – this is fatigue analysis. The cyclic nature of the loading gives a cyclic stress range within the structure. That in turn leads to generation of microscopic fractures in the structure material, which can, if unchecked, grow and lead to structural failure.

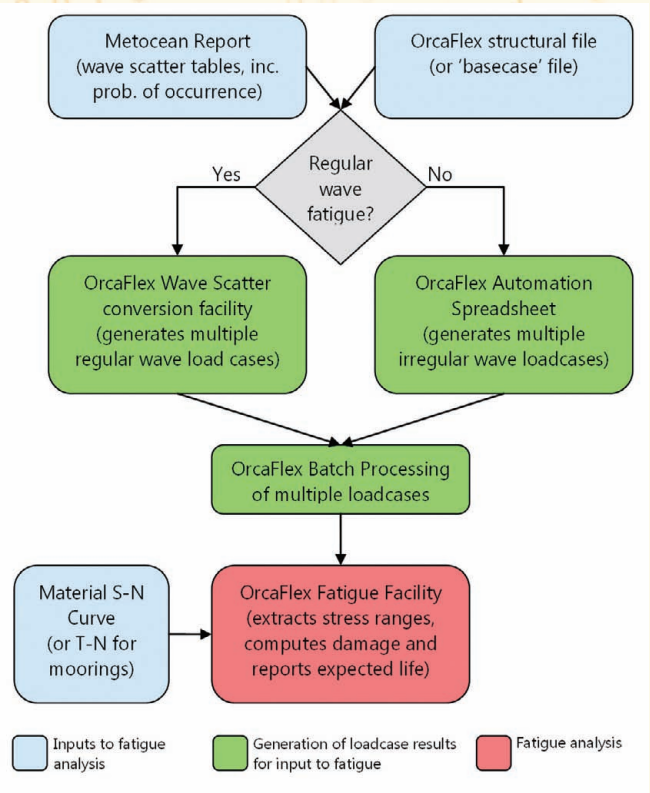
An estimation of the material fractures (the damage) and the resulting 'fatigue life' is precisely where the fatigue facilities in OrcaFlex come in. OrcaFlex can calculate fatigue for most common subsea lines, from steel pipes to umbilicals.

Fatigue Analysis - the high level version

A component can be repeatedly put under a given stress or strain for a finite number of cycles before failure. It's commonly accepted that the range of loading is the key parameter, consequently, the damage calculation in OrcaFlex uses S-N curves, together with linear damage accumulation via the Palmgren-Miner rule.

The damage caused by cyclic loading is typically expressed as a normalised fraction of lifetime. For n cycles of a given stress range σ, the damage caused will be $n/N(\sigma)$, where $N(\sigma)$ is the total number of cycles to failure (the lifetime) while cycling at a stress range of σ.

OK, that's the principle, but where do the stress ranges and the number of cycles to failure come from? In brief (with more details below), stress ranges come from the dynamic simulations performed for each loadcase, and the cycles to failure come from experimentally derived S-N curves. The chart below summarises the main steps in a fatigue analysis and identifies these 'inputs' to the process:



Each of these steps is expanded on in the following:

Step 1 – OrcaFlex Structural (Base Case) File

To determine the stresses within the structure, you must start with an OrcaFlex model of the system. This will usually consist of the floater (there is normally one involved) and line(s) of interest.

Prior to any analysis, we would use the automation spreadsheet to generate many variants, examining structural variations (in order to hone the design), and results quality as a function of mesh density (both number of elements and time step size). Once this file has been firmed up, it's then used as the base case file for the extreme and fatigue analyses by combining it with the environmental loadcases from the Metocean report.

Step 2 - Metocean Data

The Metocean report provides combinations of wind, wave and currents, together with the annual probability of occurrence, for the particular offshore location in question. This may be given as storm scatter (example shown below) or as individual wave scatter data.

Location: My site, Period: Jan – Dec, All Directions
(Cells show joint probability of occurrence, here in parts per thousand)

Wave Height (Hs), [m]	0 - 4	4 - 5	5 - 6	6 - 7	7 - 8	8 - 9	9 - 10	10 - 11	11 - 12	12 - 13	>13
> 10											
9 to 10											
8 to 9						1	1	1	1		
7 to 8					1	2	2	2	1		
6 to 7					2	4	5	4	2	1	
5 to 6				2	6	12	12	7	3	1	
4 to 5				5	19	29	25	14	5	2	
3 to 4			2	18	48	59	41	19	6	2	
2 to 3			8	46	89	82	44	16	4	1	
1 to 2		1	22	72	88	53	20	5	1		
0 to 1		5	20	27	15	5	1				

There might be a different table for each incident wave direction, or possibly only one table for all directions – it depends how much information is in the Metocean report.

Each cell in the table gives the probability of occurrence of a particular combination of wave height and period. In principle, therefore, a separate OrcaFlex simulation is required for each of these 'loadcases', although in practice cells might be grouped into a single loadcase. The fatigue damage calculation uses the probability of occurrence from each cell as the measure of exposure to that particular environment.

Step 3 – Preparing the loadcases

Regular waves: Here short simulations are the norm as all we require is that the system reaches a steady state dynamic response (five wave periods is typically sufficient). This speed allows the whole line to be considered to see where the damage is likely to be concentrated. This can guide any further investigation made with irregular waves.

To make the setup of the loadcases easy, OrcaFlex has a superb wave scatter conversion (WSC) tool fully built-in. This tool generates a regular wave scatter table from the user defined storm scatter data. However, this expansion is not perfect and tends to produce wave occurrences with larger wave heights and longer periods. Larger waves produce higher system loads and hence more fatigue damage. Despite this, there are many advantages with this approach especially in preliminary design.

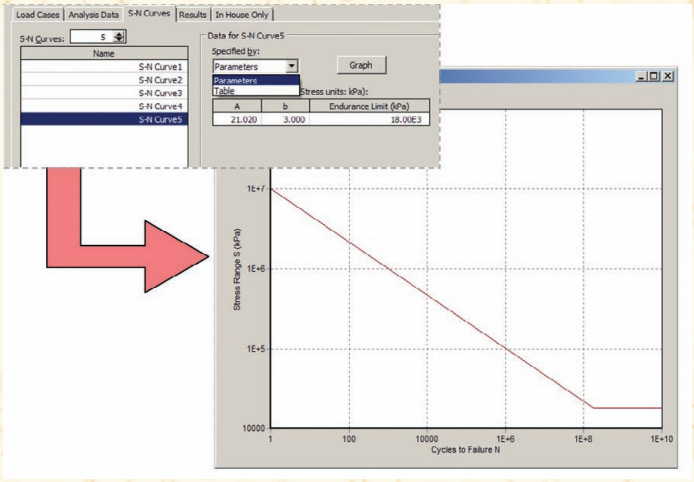
An OrcaFlex simulation is then required for each cell (or groups of cells) in the regular wave scatter table. The WSC tool will also automatically generate the loadcase files for batch processing and the fatigue data for fatigue post-processing. If you have already been given the processed regular wave scatter data, then you can enter this directly and get the WSC tool to generate the batch files and fatigue data.

Irregular waves: Irregular wave analysis is usually considered more realistic and generally gives lower fatigue damage. The drawback is that run time and post-processing time is longer. Where irregular wave fatigue analysis is required (ie, using the rainflow cycle counting approach), then the OrcaFlex simulations are run with spectral wave forms, not regular waves.

Step 4 – The S-N Curve

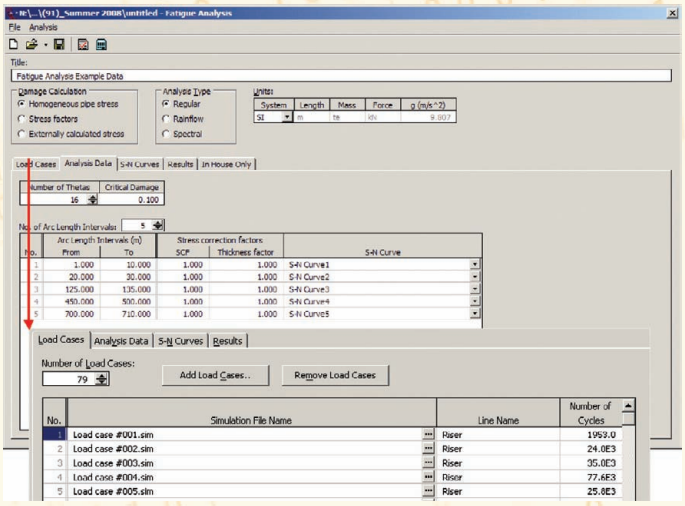
A simple S-N Curve is shown in the screenshot below; it defines the relationship between the number of cycles to failure and cyclic stress range. It's usually derived experimentally and is user defined input data to the fatigue calculation.

The Fatigue utility allows you to define and use multiple S-N Curves. This is useful when considering weld effects and different inspection regimes, material and geometry for different parts of the same line. The curve definition can be through 'Parameters' using a formula to specify the curve, or through a 'Table' with user defined data.



Step 5 – Bringing it all together – the Fatigue Analysis

Here we pull together all the information required to perform the fatigue calculations (see the screenshot below). This includes the loadcase files (for the stress ranges), the S-N Curve (for cycles to failure) and some further information (described below) necessary to run the fatigue analysis.



Looking through the further information required (roughly in order as it appears on the form):

a) Damage Calculation:

- Homogeneous pipe: Here the line is assumed to be a homogeneous pipe with linear material characteristics. The damage calculation uses axial stress only (which is fine for metallic risers).
- Stress Factors: Calculated stress is taken as being linearly proportional to tension and curvature, through user defined constants of proportionality. These data come from experiments or detailed analysis of the cross-section. Suppliers of such products are usually able to provide the necessary stress factors. This is used to determine stress in specific layers or components within more complicated cross-sections (eg, umbilicals and composite risers).

b) Analysis Type identifies whether the input loadcases contain regular or irregular waves. There is also a 'Spectral' option allowing a frequency domain damage calculation using stress RAOs derived from an OrcaFlex white noise simulation.

c) The Load Cases page identifies the loadcase simulation files and specifies the name of the Line for fatigue analysis. Remembering that each loadcase is for a specific cell in the wave scatter table, it follows that each file has an associated 'exposure' (cycles or time) to that environment. This exposure is also entered here.

d) The Analysis Data page defines the various radial and arc length locations in the line where the fatigue analysis is to be performed. For homogeneous pipes the stress ranges can be scaled with Stress Concentration Factors and / or Thickness Correction Factors. You also specify which S-N curve is to be used for the different arc length locations.

e) The Component Page appears with the Damage Calculation set for Stress Factors. It allows the stress factors for the various layers / components of a complicated cross-section to be entered, along with different S-N curves if appropriate.

Running the fatigue calculation: the 'check data' button ensures, before the calculation starts, that all the specified loadcase simulation files exist and that the named line and specified arc length intervals exist in each file. The 'calculate' button then calculates and sums the induced damage.

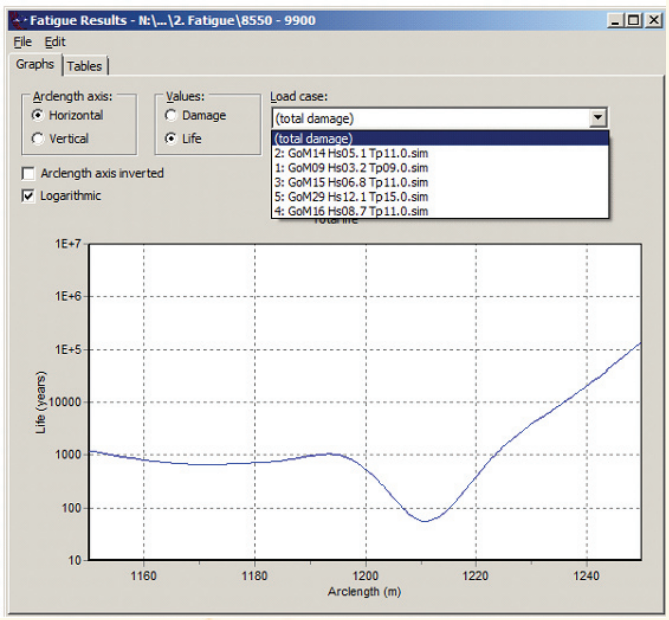
Hopefully you will notice that the calculations are now (in v9.2) multi-threaded, so that you can obtain maximum efficiency from multi-core machines.

Step 6 –Fatigue Results

Once the fatigue calculation is complete, estimates of damage and predicted lifetime are presented. These can be seen both individually for each loadcase, and as 'total' values.

v9.2 now gives the ability to save the fatigue results with the fatigue file (previously only the input data was saved!). So you no longer have to remember to export the spreadsheets or end up having to re-run the fatigue calcs! ☺

Also new is the ability to present results graphically – see screenshot. You can view graphs of either life or damage. Results are presented summed over all load cases, or alternatively each load case can be viewed individually. The spreadsheet of tabular results is still available but is not assembled until the 'tables' tab is clicked, again saving time if they are not required.



Conclusions

The facilities built-in to OrcaFlex make the setting up of the data and input files as straightforward as possible. This maximises the QA, reduces re-work and greatly speeds up the process. We hope that you get a lot out of these features, but as ever, do give let us know if you need more advice.

Applications

The intention of this new section is to give readers an understanding of some of the more unusual models and applications we've seen with OrcaFlex. We hope that this might enhance your understanding of the modelling possibilities with OrcaFlex….

MPU HEAVY LIFTER

OrcaFlex versatility deployed for mating and decommissioning studies…

The Application: The company Dr techn. Olav Olsen (www.olavolsen.no) worked on the global dynamic analysis of the Multi-Purpose Unit (MPU). The MPU is primarily a 'U' shaped floating decommissioning structure, built in concrete.

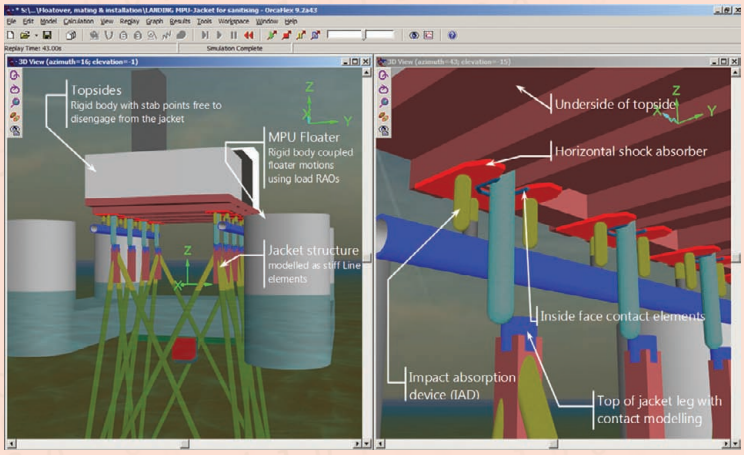
Global modelling is important to develop an understanding of:

- the relative motions between the MPU and the fixed platform
- the subsequent mating contact
- the effect of the topside weight on the floater
- the possibility of, and effect of, subsequent intermittent contact.

The Model: The MPU is modelled as an OrcaFlex Vessel using Load RAOs. Hence the vessel responds to calculated wave loads, any contact loads and load from the topsides.

Each Shock Absorber (SA) comprises several OrcaFlex objects: Three single segment lines represent the non-linear behaviour of the Impact Absorption Devices (IAD). The lower and upper ends are connected to the MPU and an OrcaFlex 6D Buoy (the thin red 'U' shape) respectively. The IADs respond with intermittent contact between the SA and the underside of the topside structure. Friction between the SA and the underside of the topsides is also modelled.

The SA inside 'edge' comprises short, single segment OrcaFlex Lines. These are contact elements between the inside of the 'U' and the jacket leg, allowing the SA to 'locate' around the jacket legs as the arms cantilever across.



The tops of the jacket legs also include contact elements, allowing potential intermittent re-contact between the lifted jacket leg and the remaining jacket structure to be modelled.

The MPU uses a DP system and it's important to be able to model this. OrcaFlex includes this through the Applied Loads facility on the Vessel data form together with a user-written external function containing the DP control algorithm.

In Conclusion: This OrcaFlex decommissioning model shows the importance of modelling fully coupled vessels, having flexible and versatile contact modelling and the ability to admit DP control algorithms. It was also made significantly more tractable by using the advanced Object handling features available in the Model Browser.

STINGERS AND PIPELAY

Long used for pipelay analysis, here's an excellent showcase example…

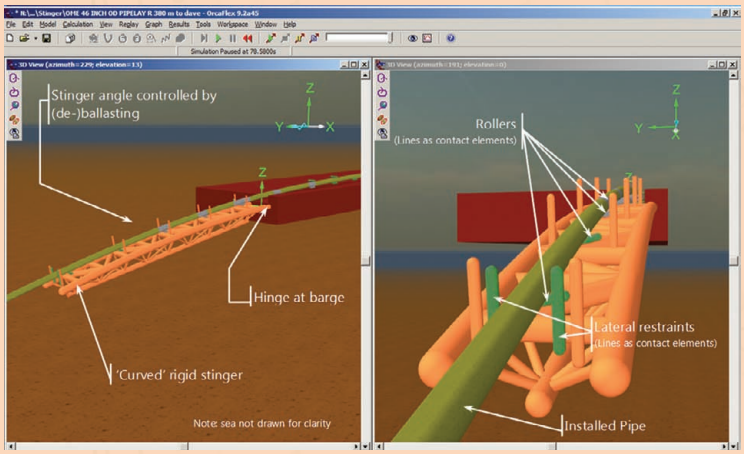
Modelling pipelay dynamics is increasingly common and OrcaFlex is widely used for the dynamics of rigid, hinged, articulated and floating stingers. Here we look at a specific stinger application (see screenshot) where the contact formulation and flexibility inherent in OrcaFlex are used to good effect.

This model was developed by our SE Asia Agents (Zee Engineering, www.zee-eng.com). In addition to OrcaLay (2D static screening studies for multiple pipelay cases, load case summaries, automatic code checks and user defined limits on pipelay operation), they extensively used OrcaFlex for pipelay dynamic analysis. (An OrcaFlex model is generated from OrcaLay through a simple check box.)

The Application: Here a rigid, curved, floating stinger, hinged at the lay barge connection, is shown. This is a ballast controlled floating stinger, with the following advantages:

1) No support A-frame necessary, saving deckspace with more freedom for crane movementsetc.
2) Traditional stingers installed with overhead cranes are held in position until connected to the vessel. A floating stinger can be floated to the stern and connected with minimal craneage, etc.
3) Greater accuracy on stinger angle can be achieved using the internal ballasting system.
4) The curved stinger offers the advantage of maximising the overbend adjustment gain through roller height adjustment.

The Model: The distribution of properties in such a model is described using appropriately sized single segment Lines (connected to a 'dummy' 6D Buoy) to represent the structure. How many are used depends on the accuracy required. In the case of this curved stinger, quite a lot of detail and analysis is required to ensure that the combination of mass, ballast and buoyancy give the desired stinger angles.



The rollers and lateral restraints are single segment OrcaFlex Lines used as contact elements. Clearances are continuously monitored – zero leading to a contact and the resulting reaction feeds into the post contact behaviour. The contact modelling on OrcaFlex, long recognised for its robustness and versatility, easily handles this.

The barge can admit the loads from the waves, pipe and stinger, mooring system and / or DP system, so you can model a fully coupled system. The dynamic solution uses either the implicit integrator, or the explicit scheme if severe contacts need to be quantified.

All results, including clearances and pipe-roller/restraint contact loads are derived as normal (graphs, tables post-processing). Graphs can be displayed as the simulation progresses - no need to wait until the simulation finishes to see them!

Agents News

Many of you will be aware that Orcina's activities around the world are supported by a network of agents in all the major Oil and Gas centres who form a central part of Orcina's marketing and technical support activity. As such we thought it might be useful to keep you up-to-date with who they are, what they do and some of their recent news….

Whilst our agents are mostly geographically remote from us, we have very close working relationships with them, often with daily contact. With most we have long standing relationships going back many years. This engenders strong technical communication which is very important in seeking to serve our clients in the best way possible.

We hope that this page will keep you abreast of the latest developments with our agents so as to better understand what they do and hence get the most from your use of our software.

Here is our current list of agents and their contact details:

USA, CANADA & MEXICO	Bil Stewart, President, Stewart Technology Associates info@stewart-usa.com, www.stewart-usa.com, +1 (713) 789 8341
	Paul Jacob, Associate, MMI Engineering pjacob@mmiengineering.com, www.mmiengineering.com, +1 (281) 920 4600
SOUTH AMERICA	Nelson Galgoul / Claudia Interlandi, SUPORTE Consultoria e Projetos Ltda suporte@suporte-cp.com.br, www.suporte-cp.com.br, +55 21 2113 1717
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MALAYSIA, INDONESIA & SINGAPORE	Herman Perera, Managing Director, Zencomp Consultants Sdn Bhd herman.perera@zee-eng.com, www.zee-eng.com, +60 (03) 7877 8001
INDIA & MIDDLE EAST	Tarun Rewari, Managing Director, Aryatech Marine and Offshore Services Pvt. Ltd info@aryatech.net, www.aryatech.net,+91 11 46 01 81 02

Most of our agents are practising engineering consultants in the Offshore Oil and Gas industry. Here we highlight the first agent that Orcina had, and also our most recently appointed agent.

NORTH AMERICA

Reflecting that it's our largest market, we are served here by the joint agency of Stewart Technology Associates and MMI Engineering. They work very closely together supporting OrcaFlex users and on projects, both related and unrelated to OrcaFlex, where either company may be the prime contractor and the other a sub-contractor.

STEWART TECHNOLOGY ASSOCIATES

Bil Stewart, founder of Stewart Technology Associates (STA, www.stewart-usa.com) was our first Orcina Agent, starting with us in our first year of operations, 1986. STA was also founded in 1986, based in Houston, and over the years has become an extremely broad engineering consultancy but with its roots firmly embedded in the dynamic analysis of offshore structures. Given that early start, Bil (yes, with only one 'l')is one of the few people who remembers the DOS versions of our software!

As well as working to support our clients in the Oil and Gas Industry, STA has helped us get our software accepted by the US Navy and various US Government Defence Contractors. Bil has also used OrcaFlex on numerous STA consultancy projects, including a recent novel moored concrete barge design for the US Air Force.

Over the years many of the engineers and interns who have worked for Bil have gone on to become senior engineers in other companies and continue to use OrcaFlex. In the last three years STA has taken interns from overseas (Germany, France and India) during the summer months and has provided training (approved by the US Government) in dynamic analysis and offshore structures in general. OrcaFlex has always been a part of this experience.

STA is currently designing mooring and riser systems in Korea, Indonesia and Vietnam with OrcaFlex as the fundamental design tool. Aryatech (Orcina agents in India) and STA are working on several projects in India while at the same time Bil is helping train young Indian engineers in Aryatech in the use of OrcaFlex and in hydrostatic stability using daily video conferences.

MMI ENGINEERING

MMI Engineering (www.mmiengineering.com) have acted as joint North American Agents for Orcina since 2001. MMI started in that year (hence the name – in roman numerals) in Houston, but now has offices on the US West coast (Oakland, Los Angeles, Seattle-Tacoma) and in the UK (Warrington and Aberdeen). Next year they are planning to open offices in Perth, Australia and Kuala Lumpur. Although MMI are involved in a diverse range of technologies, OrcaFlex has become a mainstay of their work in Houston, be it for the training of new users, technical support to the user base or use on projects. Last year they successfully applied OrcaFlex in an undergraduate course for offshore systems.

The principal point of contact at MMI for OrcaFlex is Dr Paul Jacob (pjacob@mmiengineering.com). Paul's first use of OrcaFlex was in the mid 90s when he worked on SCR configurations for FPSOs. Over the years he has used OrcaFlex for a broad range of projects including the design of flexible and steel riser systems, offloading systems and moorings for wave energy converters.

INDIA AND THE MIDDLE EAST

Aryatech Marine & Offshore Services is a marine and offshore engineering and consultancy company with their head office in Delhi, India. It is headed by Tarun Rewari who has over 30 years of experience in the Marine and Offshore related fields.

Aryatech's extensive experience with ships, Jack–Ups, Semi-Submersibles, Drillships, Risers and Pipelines enable them to provide the clients with professional and cost effective solutions. Aryatech also offers an array of software packages like OrcaFlex and SACS which are used by engineering firms, drilling contractors, oil companies, Classification societies, and shipyards worldwide.

In the past, much of India's offshore oil and gas development has been in shallow waters, mainly off Bombay High. Presently, only 20% of the country's consumption is being supplied through these reserves. Consequently, India has been undertaking deepwater exploration - the latest discovery is in around 4000 feet water depth off the India East coast (Krishna Godavri basin). This is being developed by Reliance Industries, a private organization, and the first FPSO Dhirubhait–1 is now proceeding to this location.

Recently, a number of major overseas offshore design engineering companies have set up their offices in India to provide support services to their overseas office and to carry out domestic offshore engineering work. This has increased the training and development of personnel for the industry, which had previously been in short supply. A few of the companies setting up in India include: Saipem, Aker Solutions, Mustang, Samsung, Worley Parsons, McDermott - all of these are clients of Aryatech.

Another recent development is the introduction of offshore related courses in the Engineering colleges in India leading to MTech degree in Ocean Engineering & Naval Architecture. Recently, the Indian Institute of Technology Chennai has taken a license of OrcaFlex. Also, some research institutes (eg, National Institute of Ocean Technology - Chennai) have started using OrcaFlex.

Overall the prospects for the deepwater offshore industry look exceedingly good in India. Although not an area in which 'India Inc.' has a great deal of experience, through the advent of overseas companies locating here, the reversing of the 'brain-drain and new indigenous university courses, this lack of experience is being rapidly plugged.

News in *Short....*

ORCAFLEX USER GROUP MEETINGS AND OPEN TRAINING COURSES

The annual OrcaFlex User Group Meetings (UGM) and associated 2-day Open Training (OT) courses have really established themselves in the calendar now. We're delighted that so many users attend these events and are hopefully taking away ideas and information on the new features to make their analysis work more straightforward.

We hold these meetings towards the end of each year and have now settled on a standard set of venues: Aberdeen, Paris, Stavanger, Houston, Rio de Janeiro, Perth and Kuala Lumpur. The 2008 round of UGMs and OT have just been completed and this year we covered the following topics:

New features in version 9.2a: Including wake interference, non-linear seabeds, wave spreading, bend stiffener / TSJ modelling, speed up of fatigue analysis, multi-threading and much more! We also introduced plans for future OrcaFlex development.

Fatigue Analysis: Essential in most analyses, OrcaFlex has a wealth of features making it as straightforward as possible. The talk covered: comparison of regular and rainflow analysis results and timings, as well as wave scatter conversion.

Statics: We covered some theory and gave practical advice on how to solve statics convergence problems. Worked examples covering seabed friction and solid contact were also presented.

Pipelay: OrcaFlex is extremely well suited to this application and is routinely used. We demonstrated this with fixed, hinged and flexible stinger models.

Worked Examples: Responding to feedback from previous UGMs, we included some longer examples including: passive and active heave compensation, spoolpiece manoeuvring, sparbuoy short wavelength issue.

In addition there was a guest presentation by a local OrcaFlex user at each meeting.

We plan to continue to hold these meetings in future years in a similar format. The meetings are extremely valuable to us for guiding the future development of OrcaFlex and we hope that you, the OrcaFlex user, find them just as useful.

Our open training courses run throughout the year, not just in conjunction with the UGMs. Please refer to our website for a full programme.

RECRUITMENT

Our software continues to be in great demand, resulting in a large increase in the number of licences in use worldwide. To support this we are looking to make a couple of long term appointments in the following areas:

Mathematical / numerical modelling: To work in our software and technology group, developing and testing new features for OrcaFlex. The successful applicant will have a strong mathematical background, experience of developing numerical models, and the programming skills and attention to detail to support that.

Consultancy: To work in our consultancy group, providing OrcaFlex technical support and training, and consultancy services, to clients around the world.

Both positions are at the heart of the OrcaFlex development project, work that has led OrcaFlex to be the pre-eminent tool in its class. If you are interested in becoming a long term part of the OrcaFlex team, living and working near the English Lake District, then please see 'Employment Opportunities' on our website at www.orcina.com.

IN THE NEXT NEWSLETTER

Having just pushed OrcaFlex version 9.2 out of the door, it's still pretty early to tell what developments we'll be reporting on next time. However, features which are high on our list include:

- Pipe-in-pipe analysis.
- P-y and T-z curves for vertical risers.
- Restarts.
- Hinges and articulations.
- Extreme value post-processing.
- Improved splash zone modelling / Slamming.
- Curved cylinder shape for J-tube pull-ins.
- Better support for multi-core hardware.
- Improved post-processing spreadsheet performance.
- Line payout, especially for modelling inertia and drag on 'Lines'.
- System modal analysis.
- Text datafile I/O to further improve automation and QA.

Obviously we can never guarantee that these will appear in OrcaFlex but it is likely that most of these will at some stage! As ever, if you have any feedback on existing features, or planned new ones, then we'd be delighted to hear from you.

Did you *Know....*

a) ...that script tables can be transposed, so you can have your loadcases in columns if you prefer.

b) ...vessel QTFs are now available for 6DOFs, particularly for assessment of second order vertical SPAR motions.

c) ...you can enter a system in field coordinates and then use the move facility in the model browser to re-locate to (0,0,0).

d) ...single segment lines with built in connections can be used as hinge pins. The can be used to model a large number of different applications. We plan to add a specific hinge object for v9.3.

e) ...a button has been added to the 6D Buoy form which allows you to set properties appropriate for a dummy buoy. The button is called "Give Buoy negligible properties".

f) ...line Setup Wizard can now include lines in the static calculation for which no targets are needed, for example, for upper/lower catenary models.

g) ...6D Buoys have a data item called Total Contact Area. Setting this to zero disables contact modelling between 6D Buoys and solids/seabed.

h) ...when annotating OrcaFlex screenshots in Word, the grouping and control of the image and annotations can be traumatic. However, the Insert | Object | Microsoft Picture action can be used to collate these into a single picture object. Once you close the picture object handling the resulting combined 'picture' in the document is very much more straightforward.

i) ...the statistics of any time history can be obtained. These include, on a stage by stage basis, the minimum, maximum, mean and standard deviation.

j) ...a default workspace file can now be set for individual files in a directory.

k) ...you can right click on an object data form and select 'Properties' to get a summary of its properties.

Orcina - out and about

Location	User Group Meetings (all 2008)	Open Training (all 2008)
Rio de Janeiro, Brazil	25 Nov	26 & 27 Nov
Aberdeen, UK	02 Dec	03 & 04 Dec

At the time of writing, the OrcaPlan for 2009 is not yet gelled. However, we will, as usual, be attending OTC in Houston as well as running the User Group Meetings during the second half of the year.

The most up to date information can always be found at www.orcina.com/UpcomingEvents.

Orcina

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