



The New 6 Page Orcina Newsletter

Welcome to the May 2004 Orcina Newsletter, issued to coincide with the release of OrcaFlex v8.5. As usual there is lots to say, and to help with this, we have moved to a new 6 sided newsletter format. OrcaFlex has many new features and, as normal, we have selected some we think to be the most useful, and given these more press.

As well as the usual News in Short and Did you Know sections, we have two main articles: One deals with the programmers interface to OrcaFlex - although this has been around for a while, we thought it was time to publicise it better. The second main article details an OrcaFlex validation case for coupled torsion-bending behaviour.

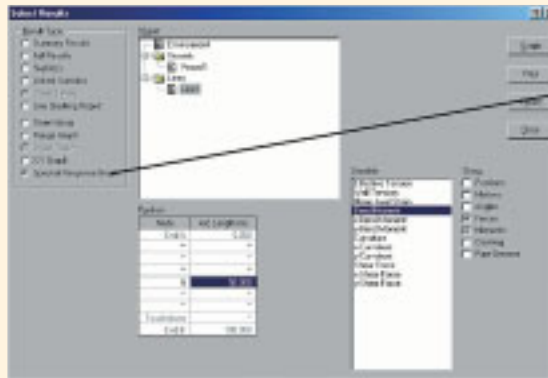
If you have any comments on the Newsletter, or suggestions for the next one, then please do not hesitate to contact us at orcina@orcina.com. We hope that you find this newsletter informative and useful...

Spectral Response Calculations

There are a number of areas where spectral analysis in the frequency domain can save a lot of time and effort, with only modest loss of accuracy. To assist in this, we have now added a new feature to OrcaFlex called the Spectral Response Calculation. This allows the user to generate Response Amplitude Operators (RAOs) for any variable in the model. These RAOs can be exported from OrcaFlex in the usual way for the user to post process as they wish. However, the key development is that the OrcaFlex fatigue calculation can now perform a frequency domain fatigue analysis based on these stress RAOs.

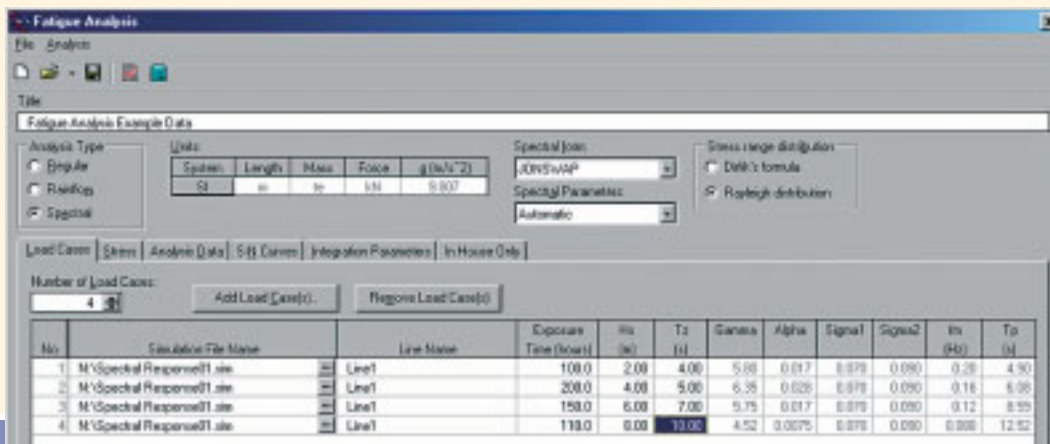
The Spectral Response Calculation happens in 4 steps:

- Set up your OrcaFlex model in the normal way.
- On the General Data form, set the From and To fields on the new Response Calculation tab.
- On the Environmental Data form, on the Waves tab, set the Wave Type to Response calculation (a white noise spectrum is employed so that a wide range of frequencies are included).
- Run the OrcaFlex dynamic simulation in the usual way.



You then have two choices according to what you want to do next:

- From the results form select the new Results Type 'Spectral Response Graph', and the variable for which you want the RAO, and this can then be graphed and exported in the normal way.
- Alternatively save the simulation file and add it as a load case to the OrcaFlex fatigue calculation. Set the Fatigue analysis type to Spectral, add the load case file, and then you can set the wave spectrum parameters.



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OrcaFlex derives RAOs from time domain simulations in random waves by a technique which has been used for many years for analysis of physical model tests. A response spectrum for the parameter of interest (axial stress, say) is derived by FFT (this facility has been in OrcaFlex for some time) and the RAOs are then obtained by dividing the response spectrum by the input wave spectrum. If you ask for a spectral fatigue analysis, OrcaFlex extracts the relevant stress RAOs by this method, then combines them with the wave scatter diagram to determine total fatigue damage.

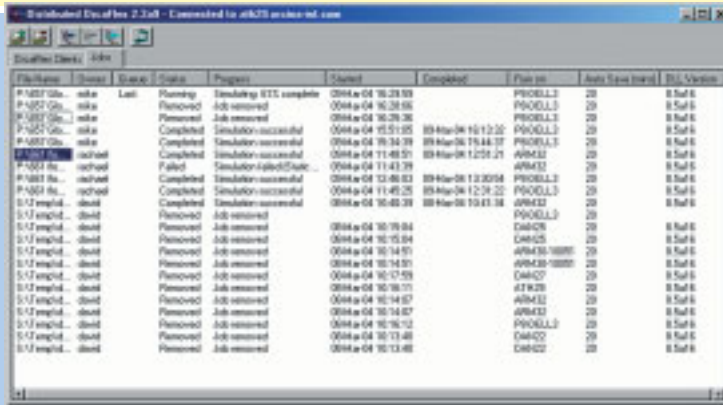
We hope you get a lot from using this new development and, as usual, please let us have your comments – these are always gratefully received.

Include Line Forces on Wave Frequency Vessel Motions

The OrcaFlex Vessel object has been considerably extended. Previously, and in common with accepted industry practice, wave frequency effects were modelled as imposed vessel motions (Vessel motion RAOs). Other forces, particularly from lines attached to the vessel, were not included on the wave frequency vessel motions (although wind, current and wave drift loads affect the vessel motion in the usual manner). This is quite acceptable in many practical situations, but this approach can be difficult to justify for jetty mooring analysis, shallow water mooring analysis, bundle towing, etc.

New in v8.5, you can optionally allow the vessel wave frequency forces to be calculated by OrcaFlex (as long as you supply the wave load RAOs). Having done this, it was a simple extension to include any other forces in the calculation of vessel motions – lines being of particular importance.

Note that in order to calculate the wave frequency wave loads on the vessel we are now solving the vessels equation of motion in each of the 6 degrees of freedom. With the wave forces and hydrostatic stiffness supplied, we need to also give information on the damping and added mass to be applied. At the moment these are considered constant with frequency, although we intend to remove this limitation in the next release.



File Name	Status	Queue	Status	Progress	Started	Completed	Plan ID	Auto Save Interval	Run System
P:\001\Gls..._v8.5	Wait	Wait	Planning	Simulation: 0.0%	0004-04-10:28:03		PROCELL	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Removed	Job removed	0004-04-10:28:06		PROCELL	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Completed	Simulation successful	0004-04-10:28:38		PROCELL	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Completed	Simulation successful	0004-04-10:34:39	00 Hour:00:19:44:37	PROCELL	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Completed	Simulation successful	0004-04-11:48:51	00 Hour:00:12:58:21	ARM32	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Failed	Simulation failed (Queue)	0004-04-11:43:39		ARM32	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Completed	Simulation successful	0004-04-10:48:03	00 Hour:00:13:00:04	PROCELL	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Completed	Simulation successful	0004-04-11:48:25	00 Hour:00:12:58:22	PROCELL	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Completed	Simulation successful	0004-04-10:48:38	00 Hour:00:13:01:38	ARM32	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Removed	Job removed	0004-04-10:39:04		PROCELL	20	8.Sul.8
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P:\001\Gls..._v8.5	Wait	Wait	Removed	Job removed	0004-04-10:14:51		ARM32-386	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Removed	Job removed	0004-04-10:14:31		ARM32-386	20	8.Sul.8
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P:\001\Gls..._v8.5	Wait	Wait	Removed	Job removed	0004-04-10:16:11		ARM32	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Removed	Job removed	0004-04-10:14:07		ARM32	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Removed	Job removed	0004-04-10:16:12		PROCELL	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Removed	Job removed	0004-04-10:13:40		DMG20	20	8.Sul.8
P:\001\Gls..._v8.5	Wait	Wait	Removed	Job removed	0004-04-10:13:40		DMG20	20	8.Sul.8

Distributed OrcaFlex

New and freely downloadable from our website (www.orcina.com/SoftwareSupport/DistributedOrcaFlex), Distributed OrcaFlex enables a collection of networked, OrcaFlex licensed PC's to batch run OrcaFlex jobs, transparently, using spare processor time. This has revolutionised the way we work here at Orcina, and we now almost always use this approach to running our simulations.

Distributed OrcaFlex actually consists of three separate programs.

- A Distributed OrcaFlex client program is run on each available PC (each must have an OrcaFlex license).
- One network machine runs a Distributed OrcaFlex server program. This co-ordinates the run list and allocates jobs to clients.
- Finally, a Distributed OrcaFlex viewer program can be run on any machine. This displays the current list of jobs and their status (e.g. pending, running, completed etc.) and allows jobs to be submitted and stopped.

Each client can be enabled (to accept jobs) or disabled (to refuse jobs) at any time. Any client can abort a running job - the server will then reallocate it to a new client and restart it from the latest stored state.

Any client runs jobs at low operating system priority. This means the job runs in the background so it does not interfere with other tasks on that machine. So if the client is otherwise idle (e.g. at night or tea time!!) then the job will run at maximum speed. But if the PC is being used, the user will not notice the background distributed OrcaFlex runs, since user work takes priority. Therefore, there is normally no need to disable clients.

Distributed OrcaFlex now includes Queue-Load Balancing (to prevent queue hogging) and Optimal Job Allocation to make the most of the fastest PCs in your office (moves jobs to faster machines as they become available).

Enhancements to the OrcaFlex Spreadsheet.

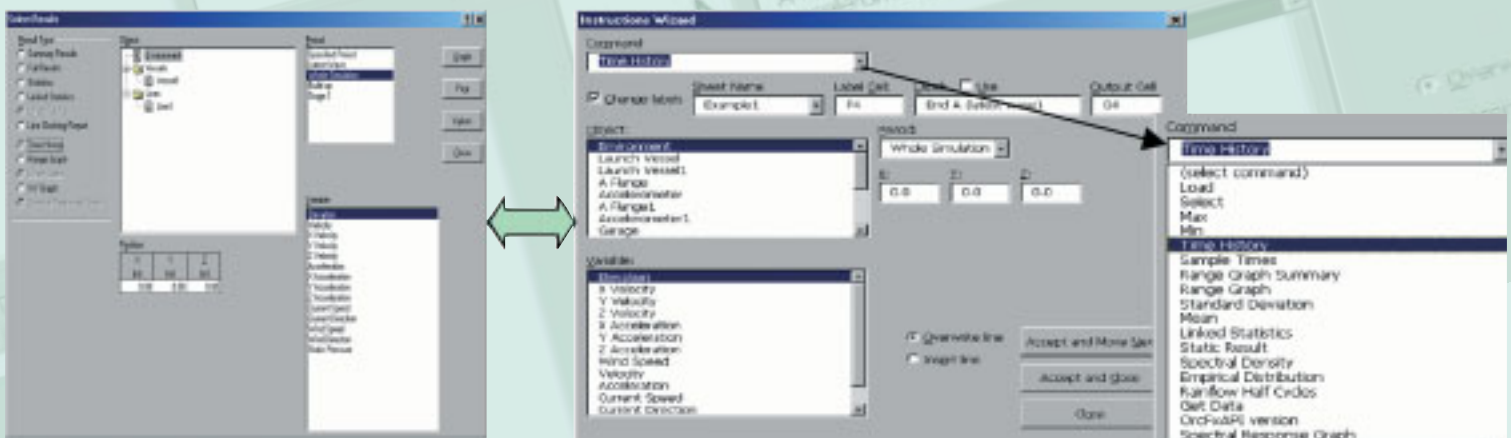
As mentioned in the OrcaFlex Automation article in the last Orcina Newsletter (December 2003), we have been working on an enhanced version of the OrcaFlex Spreadsheet. This not only includes the relatively new Script Table sheet (for automatic generation of batch script from a load case table), but now has the new 'Results Instructions Wizard', and Duplication utilities. This will be distributed in the OrcaFlex v8.5 release due out in this May:

The Results Instruction Wizard is a pop-up form from the Orcina menu item on the menu bar of the OrcaFlex Spreadsheet. Roughly, it is the automation equivalent of the results form from the OrcaFlex GUI.

The Results Instruction Wizard allows you to easily, and accurately, set up the instructions for automatic post processing of OrcaFlex data or simulation files.

When you have finished selecting the instruction set, then either of the Accept buttons, writes that instruction set to the currently selected row in the Instructions sheet. Try it and see – and please give us your feedback.

The Duplicate Instructions command is also found on the Orcina drop down menu. This allows you to repeat a block of results extraction instructions for multiple OrcaFlex files. These files can be identified by specifying the name of the batch script used to generate the files, or you can multi-select different file names through a File | Open Dialog box. If you subsequently decide that you need to change the instruction set, then you only have to do the change in the first block, then re-run Duplicate Instructions to update all the instruction blocks for all the files specified. (Remember that this will overwrite any existing instructions in the sheet, so use with care!)



The OrcaFlex Programmer's Interface and External Functions

Much of what we do here at Orcina centres on the technical specification of OrcaFlex, and its use through the traditional GUI. But, fully included with 'normal' OrcaFlex, is a programmer's interface: This allows users to build their own calls to OrcaFlex functionality from within 3rd party software – to monitor offshore pipe installation, for example. Along similar lines, the recently introduced External Function capability within the OrcaFlex GUI, allows users to define, write and link their own DLLs into OrcaFlex. This creates the potential for user defined extensive control over OrcaFlex simulations – PID controllers for winch operations are an obvious example.

This article explains a bit more about the OrcaFlex programmer's interface, what it is and how it can be used, and shows what the External Functions can be used for and why they are so powerful...

The OrcaFlex DLL

The OrcaFlex programmer's interface is a Windows dynamic link library (DLL) called OrcFxAPI. The OrcFxAPI DLL can be thought of a library of software function calls (much like a series of software subroutines). Each of these calls triggers a piece of OrcaFlex functionality – the list is extensive (and full documentation can be found on the OrcaFlex CD), but in brief, functions exist to:

- Create a model and load OrcaFlex data or simulation files;
- Create objects and set data for a model;
- Run static and dynamic calculations;
- Extract results and 3D Views.

The full list can be found on your OrcaFlex installation CD.

DLL Uses

Offshore pipelay monitoring:

The OrcFxAPI DLL is being used for real-time monitoring on offshore vessels. The typical application is to monitor a line – be it a pipe, mooring line or cable - between the vessel and the seabed. In advance of going offshore, a shore-based OrcaFlex user will have set up an OrcaFlex data file containing the base data for the system.

Once offshore, real time sensors are used to return various parameters, the positions of the top and bottom ends of the line, and departure angles and tensions. The OrcaFlex statics calculation is then used to calculate the configuration of the whole line. This enables a wide range of results (e.g. shape, tension, bend moment, stress, etc.) to be calculated and reported by OrcaFlex.

OrcaFlex post-processing:

Those who use the powerful post-processing facilities in the standard OrcaFlex spreadsheet, have already used the DLL!! The spreadsheet uses the OrcFxAPI DLL to load the specified files and extract the requested results.

Several of our clients have taken this idea and fully automated their own results extraction to their own format and output specification, and for any onwards post-processing.

External Functions

External Functions are another way of being able to set data within OrcaFlex. But they are not 'just' another way – they are extremely powerful, allowing the user to change data as a function of what else is happening in the dynamic simulation!

First, some background: Previously, data items were defined at the start of a simulation, and were unalterable thereafter (e.g. a constant drag coefficient). With the new Variable Data Structure in OrcaFlex 8.0, a look-up table (with interpolation) can be used for common relationships (e.g. drag coefficient as a function of Reynolds Number). Although very flexible and useful, the Variable Data Structure cannot handle functions of more than one variable. (Note: The Variable Data Structure is extremely useful – if you're not familiar with it then we highly recommend that you spend some time examining the existing possibilities.)

External Functions are really the next step, but they provide much greater generality than previously. The algorithm for the External Function is specified and written (or subcontracted) by the OrcaFlex user. The External Function is then 'hooked' into OrcaFlex in the right place on the OrcaFlex data form, and this allows the required data value(s) to be changed during a simulation. But key to this, is that the new data value can be a function of many variables. A typical example is a PID controller for winch tension or payout which might be designated as a function of position, velocity and acceleration – see below.

Example Applications

With orcaflex we distribute a self contained set of External Function examples. These can be found in c:\programs files\orcina\orcaflex\ExternalFunction Examples.zip - this is a very good place to start!

a) Active heave compensation:

In this application, Winch payout rate is set by an External Function for a simple example representing a lowering scenario (overboarding of an ROV). The winch PID controller has the following form:

$$\text{Winch Payout Rate} = V_0 + k_z Z + k_v \dot{Z} + k_a \ddot{Z}$$

In Conclusion

The OrcFxAPI DLL is a very powerful facility which comes bundled with 'normal' OrcaFlex. It allows programmers to build their own interface to OrcaFlex, be it for real-time monitoring or results extraction.

The new External Function facility maximises user control over an OrcaFlex simulation. By allowing users

Where:

V_0 is the target payout rate,
 Z, \dot{Z}, \ddot{Z} are the displacement, velocity and acceleration of the winch pulley,
 k_p, k_v, k_a are user defined constants.

$V_0, k_p, k_v,$ and k_a are all user set data items on the External Functions tab on the OrcaFlex Winch data form. Z is read into the External Function from the OrcaFlex dynamic simulation via the OrcFxAPI DLL- \dot{Z} and \ddot{Z} are derived by the supplied External Function.

Although this example is very simple, it illustrates the power and the flexibility of the External Function – any user defined algorithm can be coded, allowing maximum flexibility in controlling the OrcaFlex simulation.

b) Applied forces and moments on Vessels and 6D Buoys:

Here External Functions can be used to model thruster control for a ship's dynamic positioning system. Combined with the new wave load calculation on OrcaFlex Vessels, a controller can be designed based on, for example, maintaining a minimum distance from an installation.

We often define 'nominal' 6D buoys (ie buoys with negligible properties), and connect them into our OrcaFlex models (connection points for other lines and / or application of external loads.) Coupled with a load defined by an External Function these become an extremely flexible way to introduce any user defined forcing function into an OrcaFlex simulation.

c) Other Examples:

- Current Speed and Direction selected from a user defined matrix of values.
- Wing orientation as a function of target depth, or as a function of instantaneous hydrostatic pressure.

Preparing the External Function

An External Function is a DLL, i.e. a Windows program module. It can be written in any modern programming language which is capable of creating and linking to DLLs (C/C++, Visual Basic, Delphi, etc.) If you are not familiar with Windows programming, then get an experienced programmer to do it for you – or ask us at Orcina. With a clear specification, our software team can quickly write and test a DLL for you.

to write their own external software routines to set data in OrcaFlex simulations, a wide range of control and analysis possibilities has been opened up.

If you want to explore the opportunities afforded to you with these applications, then please do not hesitate to talk to us – we'd be very happy to have an informal chat to help set you up developing your own applications.

Large-Deflection Coupled Torsion/Bending



At Orcina we are always on the lookout for interesting tests against which we can compare OrcaFlex. One such that has been recently drawn to our attention is the work of Reismann who has published a numerical analysis of the large-deflection due to coupled torsion/bending of a weightless cantilever.

In this article we compare the lateral end deflection from Reismann's results, with the equivalent results from OrcaFlex tests.

Background

Reismann's work (Reismann H (2000). *Three-dimensional finite inextensional deformation of a beam*. Int. J.Non-Linear Mechs. 35, 157-165) concentrates on a beam cross section that is a narrow rectangle, $h/t = 10$, with a concentrated point load (P) applied at the cantilever tip. The key point is that the load is not exactly in the plane of the beam, but is offset at an angle γ (see the initial configuration illustrated in Figure 1). The notation here is that used in the OrcaFlex model.

As the magnitude of the applied load P is increased, the cantilever starts to bend out-of-plane (see

Figure 2), eventually reaching a buckling load where the lateral deflection increases rapidly. This elastic buckle is not catastrophic, and Reismann has found solutions extending well into the post-buckling region.

Figure 2 clearly shows the effect on the deflected shape of the application of a non-centred load. Note how the cross section at the tip of the cantilever has not only been displaced vertically, but how a counter clockwise rotation has been introduced.

Here we are comparing the lateral end deflection (Y_t) from Reismann's Example 1 results, with the equivalent from Orcaflex.



Figure 1 - Initial Configuration



Figure 2 - Deflected Shape

OrcaFlex Model

So how to model this in OrcaFlex so that we can compare the OrcaFlex solution with that of Reismann? It turns out that there are two areas where the implementation in OrcaFlex requires particular treatment:

1. The Reismann analysis is for the case of zero gravity. OrcaFlex does not allow for non-standard values of gravity (in fact, it always assumes $g = 9.80665\text{m/s}^2$), nor can we model something with zero mass.

The solution to this is to immerse the cantilever in water, here with a user defined value of 1000kg/m^3 . We then give the cantilever a finite mass of 10kg/m and a cross-section diameter of 0.128379m . These combine to give precise neutral buoyancy. Note that there is no inconsistency between defining these data to give neutral buoyancy and defining the required non-isotropic properties of the beam, since the bending stiffnesses are entered as user-defined data items.

2. In order to apply the force to the cantilever tip, we attach an OrcaFlex 6D buoy, of negligible mass and buoyancy. We can then specify the components of load in global axes.

Results

Reismann's results are presented in non-dimensional form, so we therefore have some freedom in the choice of an appropriate set of properties, e.g.:

- Beam span = 10 m
- $EI_{xx} = 1.75 \text{ kNm}^2$
- $EI_{yy} = 175 \text{ kNm}^2$
- $GJ = 2.52 \text{ kNm}^2$

Reismann's non-dimensional constants are then:

$$A = EI_{xx} = 0.8333 Et^4$$

$$B = EI_{yy} = 83.333 Et^4$$

$$C = GJ = \frac{EJ}{2(1+\nu)} = 1.2 Et^4$$

(taking Poisson's ratio $\nu = 0.3$)

$$D = \frac{B}{\sqrt{AC}} = 83.333$$

$$F = \sqrt{A/C} = 0.8333$$

Reismann presents a curve of Y_t vs. Applied Load P in Figure 4 of his paper. There are five curves shown corresponding to $\gamma = 0, 0.333, 1, 3, \text{ and } 5$ degrees. We have used the automation facilities of OrcaFlex to run 20 increments of static load for each of these values of γ . The general configuration of the curves is consistent with Reismann's Figure 3.

For a more exact comparison, Prof Reismann has kindly provided numerical values for his Example 1, $\gamma = 1$ deg, in non-dimensional form. Y_t is the y-component of deflection at the cantilever tip.

P	0	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Y_t	0	0.008	0.013	0.020	0.029	0.04	0.08	0.198	0.343	0.418

Prof Reismann example

These values are converted to dimensional form using Reismann's non-dimensional constants (Table 2)

P	\sqrt{AC}/L^2
Y_t	L

Figure 3 compares the corresponding Reismann and OrcaFlex results: it can be seen that the agreement is excellent throughout the range.

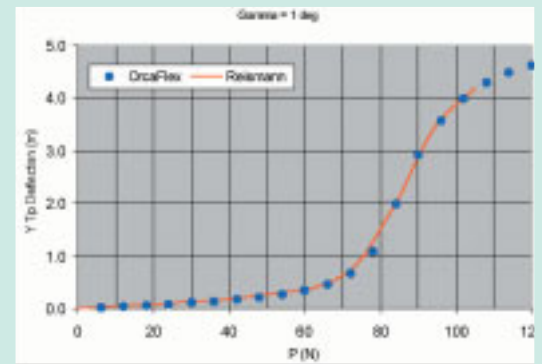


Figure 3

Discussion

The deflection curves illustrate that for $\gamma = 1$ deg the cantilever shows an elastic instability starting at about 70 N load. Other results show that as γ is increased, the buckle is less abrupt: conversely it gets sharper as γ tends towards zero.

It is interesting to compare this with the classic instability case where the load is in plane, ie $\gamma_p = 0$. See for example Timoshenko and Gere: Theory of Elastic Stability, pg 260, eqn 6-23:

$$P_{crit} = 4.013 \sqrt{\frac{EI_x C}{L^2}}$$

Note in this formula $C = GJ$. Then in our case,

$$P_{crit} = 0.0843 \text{ kN} = 84.3 \text{ N.}$$

Incidentally, in the past we have used this case as a validation test for OrcaFlex. We have found that we can predict the critical load within 0.1% or 0.2%. However it is a tricky test to perform, because one is obliged to run repeated cases, increasing the load in very small increments, and testing for stability, dynamically, by applying a very small lateral disturbance.

It should also be noted that in order to perform the comparison with Reismann's work, as illustrated above, you must have the ability to set user defined non-isotropic bend stiffness for the line.

Acknowledgement

Our thanks go to Eugene Sas of Technip who drew our attention to Prof Reismann's work

On-site OrcaFlex training.

As trailed in the last Newsletter, we have set two dates for Open OrcaFlex training sessions at our offices in Cumbria. See our website for the latest details ([www.orcina.com/Software Training](http://www.orcina.com/SoftwareTraining)), but in brief:

These are 2 day events open to any interested parties. They are aimed at elementary / intermediate level, covering a standard outline developed by Orcina. A typical course programme is available on request.

Event 1: 8th and 9th June 2004.
Event 2: 16th and 17th November 2004.

Fees are £500 per participant. This includes training materials and lunch. The course is viable with minimum of 2 attendees, and limited to a maximum of 7. Attendees should bring their own laptops. Please do not hesitate to contact us to discuss your training requirements - we look forward to hearing from you.

OrcaFlex Automation – a follow-up:

As a brief follow-up to the OrcaFlex Automation article in the last Newsletter (December 2003), the methodology outlined has been cited in a forthcoming OTC paper: 'Semisubmersible Based Dry Tree Platform with Compliant Vertical Access Risers', Mungall, C., et al, Paper Number OTC 16199.

VIV Analysis for the Norwegian Deepwater Programme:

The Norwegian Deepwater Program (NDP) is looking at many aspects of deepwater development. One specific

aim is to try to improve the understanding and prediction of Vortex Induced Vibration by CFD, or related methods. To ensure a realistic basis for the work, two drilling risers have been instrumented with accelerometers and measurements taken in a wide range of current conditions. BP are overseeing the project and Orcina have undertaken analysis of the standard test cases using all six of the VIV prediction tools currently available in the OrcaFlex VIV Toolbox. This provides a welcome opportunity to assess the models' performance against real data.

The Orcina Project reported in November 2003. NDP will consider release of data on a case-by-case basis after a period of time has elapsed for internal review. See the NDP website (www.ndwp.org), for more details of the various topics within the overall programme.

Successful Oceanology 2004.

Orcina again attended the 2-yearly Oceanology Conference and Exhibition. This was held in March of this year and claimed the largest attendance of all previous events. Oceanology attracts many non-oil and gas marine sectors – from the historical diving society, through marine salvage, site surveyors to the renewable energy sector – and for that matter, software purveyors like ourselves!

As usual we had a very busy time of it, meeting many existing clients and friends, and making lots of new contacts.

Orcina would like to say thank you to all who stopped by our stand and made the show such a success for us – see you all again in 2006 if not before! 😊

...RAO phase graphs are now **ranged automatically** to avoid parts of the curve disappearing off the edge of the chart. Previously when using the check RAOs facility the automatic scaling did not occur leading to some curves being 'clipped'. Of course you could re-scale them manually using the context menu, but how much easier now that OrcaFlex does it for you!

...that **Superimpose Times** (on the View menu) can be used to simultaneously display snapshots at user defined times? Using the Replay Control form for the current simulation allows you to optionally 'Show Trails' – this displays the overall motion envelope for all objects in the model. However, it is sometimes useful to superimpose views at discrete times in the simulation and this is where Superimpose Times comes in. As with all 3D views and graphs in OrcaFlex CTRL-C and CTRL-V will copy and paste for you!

...CTRL-A and CTRL-B give **you more control over replaying the simulation?** When replaying an existing simulation, the most common method for doing this is through the Start Replay button (). In most cases this is all you need. Occasionally, particularly when you want to focus in on one part of the replay, or step through, then CTRL-A when held down will replay as normal, and pressed repeated will step through. You can then start and stop at will. CTRL-B does exactly the same but in reverse – allowing you to run time backwards in OrcaFlex!

...that the **batch form now has a new check box** allowing you to request that OrcaFlex is closed when the batch completes. This allows better use to be made of network licences, as users can now release their claim on an OrcaFlex licence as soon as they have finished batch processing.

...that the 'Use Calculated Positions' button on the Statics tab of the General Data form causes no end of confusions. 😊 This button allows the user to set the calculated static, or dynamic

positions, for buoys, vessels and lines as the new initial positions on the object's data form. In the case of the dynamic positions, this is available at any point during a simulation. Just pause the simulation, and then you can set the object initial positions to those instantaneous dynamic values.

...Catenary convergence parameters can now be set to default values with a button on the line form. You should hardly ever need to change these data, but just occasionally, tweaking on or two of these data items can help tricky static convergence problems. Sometimes it can be difficult to remember the default values if you need to return to these. You could copy and paste them from a new line, but now the new button does it all automatically.

...Line curvature now reported for zero bend stiffness. Previously if your line type defined zero bend stiffness (e.g. for a mooring chain), then the line curvature was not calculated and therefore could not be reported. This restriction has now been removed and curvature can be derived in the usual way.

...that Vessel applied loads can be set in all 6 DOFs now? Applied loads are used in OrcaFlex commonly to model thruster systems. Previously applied forces could only act in the vessel in Global X, Y, and / or Local x, y directions, and applied moments could act in Global Z or Local z. In the latest release of OrcaFlex, applied forces and moments can now be applied in all 6 degrees of freedom in Global and / or Local axes.

...Statics Progress form now echoes the status bar so that any messages too long for the status bar can be viewed in full. Note that the status bar also displays batch progress reports, and that these are also echoed to the statics Progress form.



Successful Oceanology 2004.

...And There's More

The Pipe Plasticity Wizard

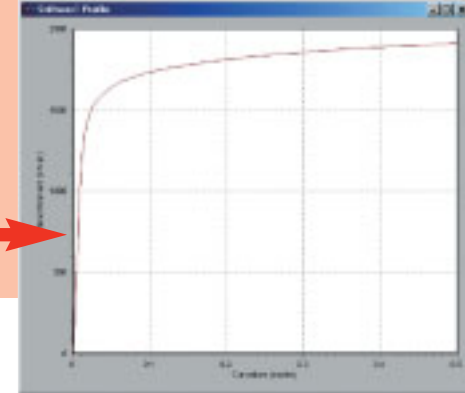
The OrcaFlex variable data structure has for a long while allowed the user to set, as a piecewise linear curve, a non-linear bending stiffness for a line. The new Plasticity Wizard allows this data to be set either through the well know Ramberg-Osgood formula, or as a Stress-Strain table.

The Ramberg-Osgood formula is based on the premise that a non-linear bending stiffness relationship is a linear sum of the elastic strain and the plastic strain:

$$\epsilon = \epsilon_e + \epsilon_p$$

$$= \frac{\sigma}{E} + A \left(\frac{\sigma}{\sigma_{ref}} \right)^n$$

All the data in this formula are fully user defined. So, for all of you who are into non-linear bending, we hope that you find the Plasticity Wizard helpful!



Benchmark program

We often, not unreasonably, get asked which computers are best for running OrcaFlex. In the past, the answer was relatively straightforward - OrcaFlex calculation speed increased linearly with the CPU clock speed. However, this is no longer true - memory speed must be increased and there are several processor technologies that perform quite differently to each other.

Despite our best endeavours, we have not managed to clarify the situation. There are more combinations of computer architecture (motherboards, processors, memory, etc.) than ever before, and it has become impossible for us to predict how these various combinations will affect the speed of OrcaFlex - the fastest machine in our office for running OrcaFlex was until recently a laptop!

So we have tried to tackle the problem from the other end and produce a benchmark program which is freely downloadable from our website (www.orcina.com/Software_Support/OrcaFlex_Benchmark). The program is compiled from the same source as OrcaFlex and runs a short dynamic simulation. The simulation is run 3 times and the reported result is the average time. Lower times mean the simulation completed more quickly, corresponding to a faster machine.

At the moment machines with the Intel Pentium-M (e.g. Centrino laptops) and the AMD Opteron are turning in spectacular performance figures - however, technology changes so quickly that we recommend you consult a range of IT suppliers before any purchase. Do not necessarily restrict your choice to Intel processors with the fastest clock speed - use the benchmark program to help you with your purchase decisions.



Target Segment length

When defining an OrcaFlex Line Object, you have to tell OrcaFlex the length of that line and also how many segments there are. Traditionally we did this by asking the user to set data for the length of a section and also for the number of segments within that section.

Not bad, but this has the drawback that if you change the length of a line section (not uncommon in the design process), then the mesh size will change! Sometimes that is OK, most of the time it is not. Generally speaking it is desirable to maintain the same size of elements whilst changing the length. That way changes in the results are down to the changed section length rather than also being affected by changes in the size of each element. (Clearly you should also check that the element size is sufficient to give the required accuracy, but that is a slightly different story.)

No.	Line Type	Section Length [m]	Expansion Factor	Target Segment Length [m]	No. of Segments	Dist. Check	Cumulative Values Length [m]	Segments
1	Line Type1	100.000	-	-	10	No.	100.000	10

Now OrcaFlex will optionally maintain the element size for you: setting the Target Segment Length on the line data form means that OrcaFlex will always try to maintain this segment length irrespective of what you do with the length of the section. Of course this can only be a target, because it is possible to end up with a combination of Section Length and Target Segment Length which give a non-integer number of segments, and you can't have that!

Exhibitions & OrcaFlex User Group:

Orcina will be present at the following conferences / exhibitions during the remainder of 2004:

- OTC, Houston, 3rd to 6th May 2004 (Booth Number 2647)

Hopefully see you there! We will also be holding the OrcaFlex User Group Meeting in the Autumn of 2004:

- OrcaFlex User Group Meeting (Europe, Late October'04)
- OrcaFlex User Group Meeting (Houston, Early November'04)

More details in the next Newsletter, but please look for updates on our website. However, please do not hesitate to contact us if you just want to ask directly 😊

In the Next Orcina Newsletter

As well as the usual digest of software developments, news and hints & tips, we will feature a couple of technical articles on...

- How to model objects colliding with underwater nets (now trailed more than once!)
- Transmission of axial shock waves