

DeepLines™ 4.5

Installation & Release Guide

July 2011



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1 Introduction

Welcome to the installation and release guide for DeepLines™ Version 4.5.

DeepLines™ is part of the marine software solutions developed by Principia and IFP Energies Nouvelles.

DeepLines™ is based on the finite elements method and forms an integrated software solution to perform in-place and installation analyses of a wide range of offshore structures including flexible and steel risers, umbilical risers, pipelines, floating hoses and mooring lines.

The software package combines a powerful finite elements engine featuring advanced modeling capabilities with an intuitive user interface offering optimum productivity through multi-threading.

This short guide provides licensed users with all the information required to properly install the software. It also provides full details about the technical enhancements and improvements brought to the graphical user interface and FE engine since the previous release of the program.

This guide is for the latest release of DeepLines Version 4.5. This version replaces Version 4.4.3.3 (Version 4.4 Service Pack 2).

2 How to install the software

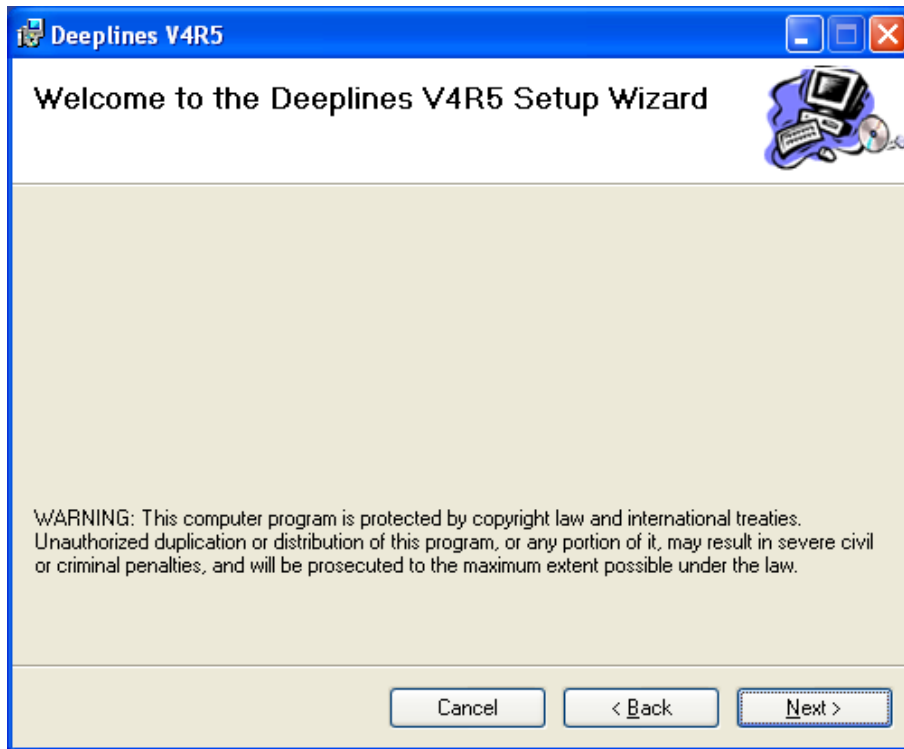
2.1 Installation instructions

DeepLines can be installed and run on any computer that has Windows XP Service Pack 3, Windows Vista Pro or Windows 7 Professional 32 or 64 bits.

There are two ways of getting the latest release of DeepLines. The Setup application may be either distributed on CD-ROMs upon request, or if you have a good internet connection, it may be easier to directly download the Setup application from our website at www.principia.fr/expertise-fields-software-products-deeplines-126.html.

DeepLines must then be installed on all end-user machines. Administration rights are required to this purpose and, when necessary, define or modify the LM_LICENSE_FILE environment variable used to specify the path to your network license file.

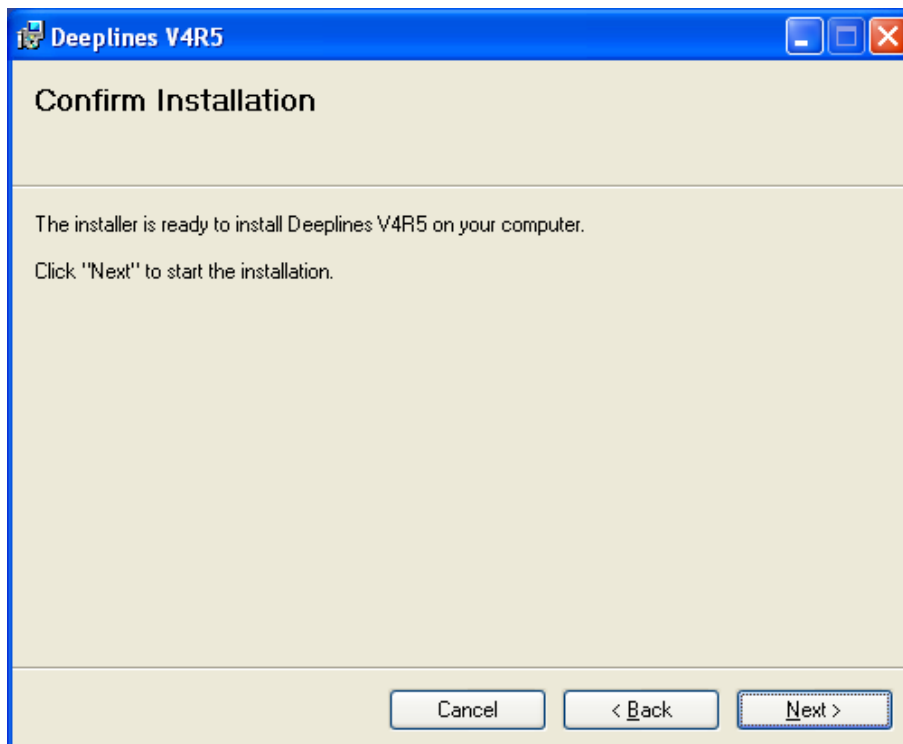
Double clicking the setup application would start the installer. Clicking on **Cancel** would abort the installation process. Click on **Next** to accept the agreement and continue with the installation. This brings in the following window.



The next window asks for the installation folder where the DeepLines files are to be copied. You may select **Browse** and further specify a directory. It is actually recommended to use the default destination folder, which is **C:\Principia\DeepLines**, rather than any other. Click then **Next** to continue.

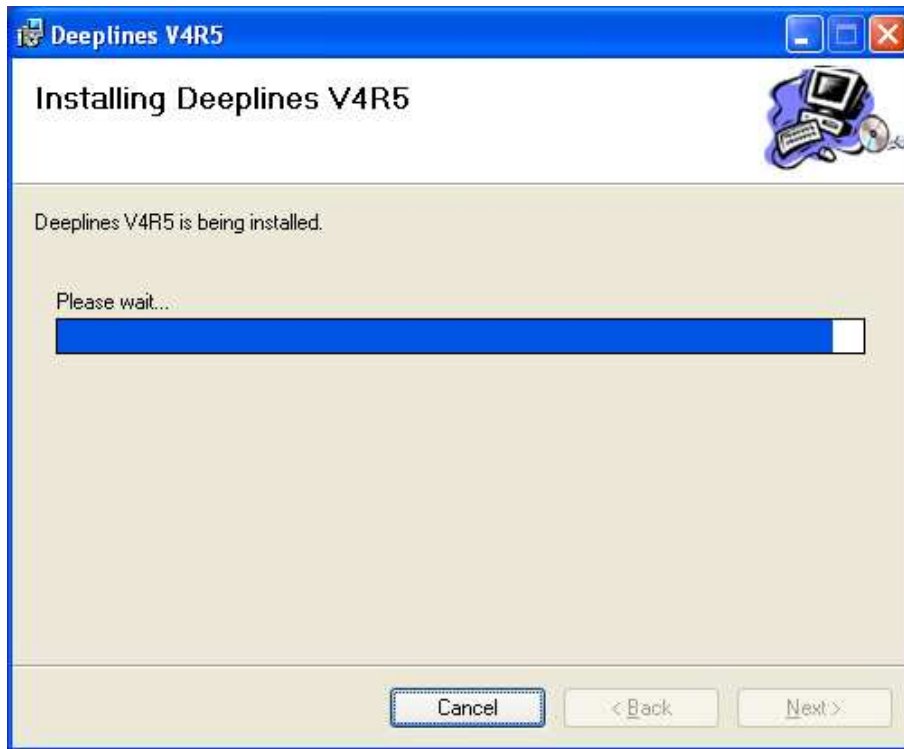


Pressing **Next** will bring in the next window which will ask you to confirm installation data :

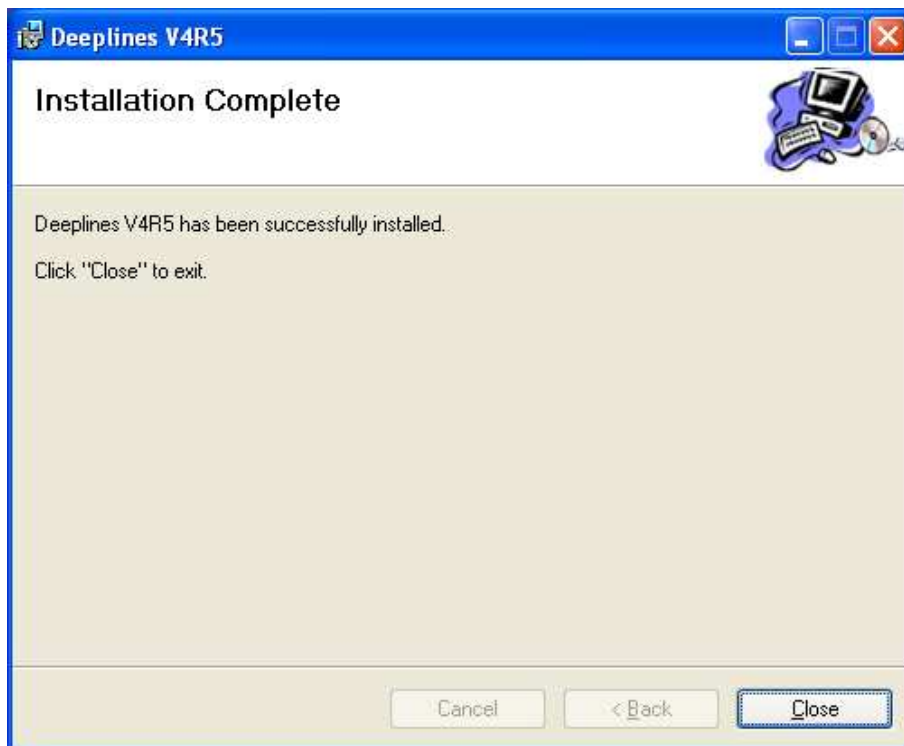


At this point you can still modify the installation settings by clicking **Cancel** to display the previous windows again. Once all settings are appropriate, click **Next** to start the

installation process. The blue bar shown in the Figure below indicates the progress of the installation. The installation may last a few minutes.



The following window displays once the installation is complete. Click **Close** to dismiss the window.



2.2 License files

DeepLines is protected through license files that may be either installed on the end-user machine or on local networks. Each license file includes a number of protection keys that define which features you are allowed to run within the GUI. The keys are either linked to the GUI or to the FE engine, as detailed in the next table.

License key in **bold** are included in the standard license package, the other keys being included in optional modules only.

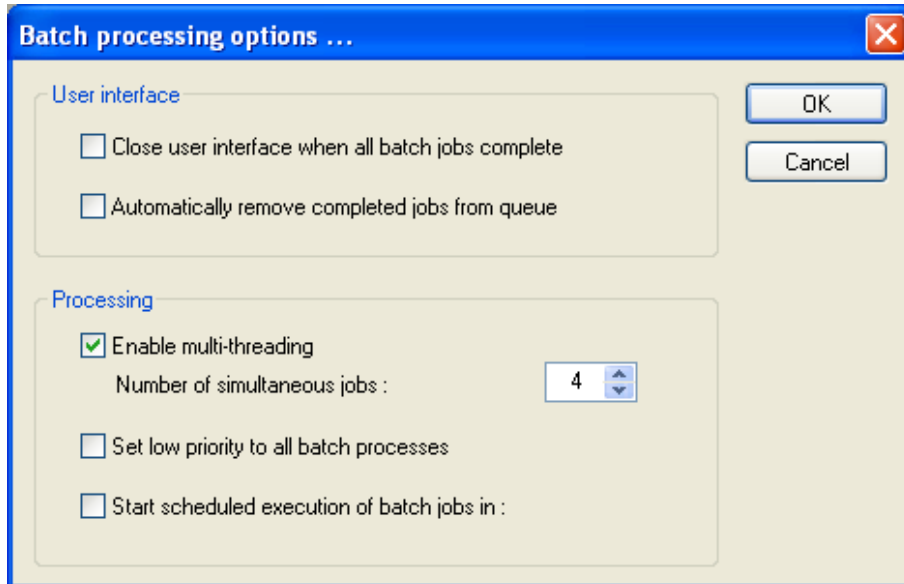
Key name	Key activated from	Functionality enabled with the key
DEEP_IHM	GUI	Access to the GUI and handling of model components Running static analyses (step 0 only) Open any existing .DSS file
DEEP_POST	GUI	Standard post-processing
DEEP_CLASH	GUI	Clash-check post-processing
DEEP_RAO	GUI	Computation of RAO for any variable based on time-traces
DEEP_QS	FE engine	Quasi-static analyses
DEEP_DYN	FE engine	Time-domain dynamic analyses
DEEP_MOD	FE engine	Modal analyses
DEEP_ZON	GUI	Zones post-processing module for flexible pipes
DEEP_SOIL	GUI	Access to pipe/seabed predefined interaction models and suction
DEEP_SLUG	GUI	Access to Internal content variations of risers (including temperature, weight & pressure variation)
DEEPVIV	FE engine	VIV analyses based on DeepVIV's modal approach
DEEP_FAT	GUI	Fatigue analyses
DEEP_DRR	GUI	API RP 16Q and iso-angle curves post-processing for drilling risers
DEEP_FREQ	FE engine	Frequency-domain dynamic analyses
DEEP_TRE	GUI	Access to Trelline™ hose type modeling (restricted access submitted to Trelleborg's authorization)
DEEP_VDP	GUI	Van Der Pol oscillators to model fluid/structure interactions
DEEP_LMRP	GUI	Additional module used to model kill and choke flexible lines connected to Lower Marine Riser Packages.

License files are distributed by Principia when purchasing the software. Using multiple protection keys allows to tailor your installation depending on your needs. The different modules from the GUI may be accessed provided that the corresponding facilities are enabled through your license file.

It is advised that you check out with your network administrator or IT department which licenses keys are actually available within your installation.

2.3 Enabling multi-threading

Multi-threaded execution of analysis and post-processing tasks is available since Version 4.5 through the **Batch Processing** form.



This Version enables running up to 4 concurrent tasks using a single license key. This however requires that the License Manager installed on the license server is upgraded to Version 9.2.

Version 9.2 of the License Manager software may be downloaded from our website at www.principia.fr/expertise-fields-software-products-deeplines-126.html (see the section titled "Download")

2.4 Before you start...

Once you have successfully installed the software on your machine, there is a recommended check list to review before you actually start working with the latest release.

- **Check the availability of your license file** : When started, the GUI will automatically check that a license file is available either on your hard drive or through your local network. Most of the installations are based on network licensing, which means that the license file is located on a local server. The path to access your license file must be specified through a system variable named LM_LICENSE_FILE. If you were not given administrator privileges, then contact your network administrator to check the content of this variable and modify it when necessary.

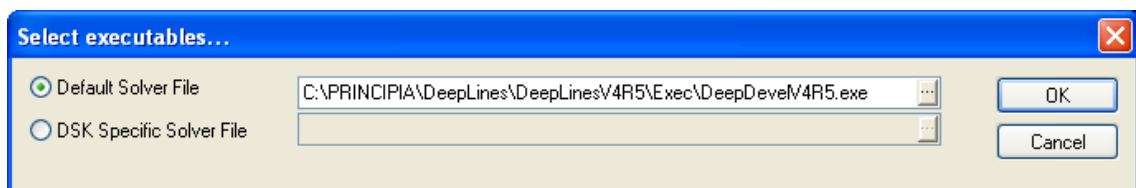
- **Compatibility with Windows 7** : Windows 7 Professional is fully supported provided AERO themes are not activated. Using AERO themes may result in minor displays issues.

- **Reduce the hardware acceleration** : The hardware acceleration is a parameter that controls whether the graphics will display on your screen using the main processor or the graphics driver. Using the latter allows better performances when displaying complex 3D graphics. A few compatibility problems have however been observed with the previous release between particular graphics drivers and several OpenGL subroutines used by the GUI to display the objects in the 3D View window. This bug has now been fixed for most of the graphics drivers available on the market, but could however persist on particular instances. This bug would cause the GUI to close abruptly without displaying any error message. We therefore strongly recommend that you set the hardware acceleration to zero. This operation is perfectly safe and has no effect at all on the performances of the main processor.

- **Files compatibility** : Both GUI and solver programs support backward compatibility. This means that you can re-open any model file (*.DSK) or simulation results file (*.DSS) created with a previous version of the GUI, using this latest release of the GUI. You can also re-run the solver with any analysis input file that used to run with a previous version of the solver. However we do not support forward compatibility. You will not be able to re-open with a previous release of the GUI any model file or simulation results file that was generated from scratch or saved using the Version 4.3 of the GUI. Should you try this, then an error message would display, indicating that the file format is not correct. Similarly, there is no guarantee that you will be able to run an analysis input file (*.LOG) using a previous version of the solver, in case the file was created with the latest release of the GUI. It is however worth noting that most of the existing keywords can be properly interpreted by the latest version of the solver and the previous one.

- **Open, save and re-open the model files created with a previous release** : As you open a model file that was created with a previous release of the GUI, it is recommended to save the file, then close the file and finally re-open this newly saved file. This operation will ensure full compatibility of the files and specifically of the analysis input files (*.LOG) that will be created with the latest version of the GUI. For instance, the blank spaces in the support vessels names will be automatically replaced with underscore characters. This further ensures that the hydrodynamic database file name used to store the RAO data will contain no blank space as required: a blank space in the .HDB file name would indeed cause an error as the solver reads the analysis input file.

- **Update the path to the solver executable file** : Once you have installed the GUI, you must check that the path to the folder containing the executable file for the solver is correct. This can be done from the Settings menu by selecting the Path to executable item. The following dialog box will display, from which you can specify the correct path.



This path will then be stored within the registry keys as you close the GUI. In case the path is not correct, you will not be able to run the solver. Should the path refer to an

older version of the solver, then compatibility problems might occur when reading the analysis input files (*.LOG).

3 What's new in this Version

There is a significant number of technical enhancements between the previous versions and Version 4.5, as detailed in the following Sections.

3.1 Changes to the user interface

- **Batch processing facility:** The batch processing form is a new facility which enables advanced automation of analyses and post-processing. Within this form, you may setup a list of batch jobs which are to be run and further monitor the status of these jobs while they are running. The batch processing form may be used to setup the analysis files, run static and dynamic analyses, post-process any type of result including fatigue damage, export these results to Excel spreadsheets, and run any Windows command through script files.
- **Multi-threading:** Most of modern processors have several logical cores. Multi-threaded execution of analyses or post-processing tasks is now enabled through the Batch Processing facility. Claims over network licenses have been improved to allow up to 4 tasks being run concurrently with a single license.
- **Clearance check analysis facility:** The lines' clearance check form is a new tool which may be used to derive the minimum clearance between several lines for series of static and dynamic analyses. This tool enables efficient definition of interference load cases to be assessed and provides clear outputs in tabular forms. Clearance analyses may be run either in interactive mode or in batch mode using the Batch Processing facility.
- **Compatible with Windows 7 :** Although the previous version of the FE engine was already compatible with Windows 7, the previous versions of the user interface could not be run correctly with Windows 7. This Version now fully supports Windows 7 Pro 32 and 64 bits. This Version also offers display based on Windows 7 and Windows XP styles depending on your operating system.
- **Display of Quick Data Access form:** Displaying calculation parameters for a range of analyses within the Quick Data Access form required that you selected first the Analyses Set from the Model Browser. The contents of the form was left empty otherwise. We have added a new data field in the Quick Data Access form which enables selecting the Analyses Set for display directly from the form.
- **Display of connections in the Quick Data Access:** Connection of all lines end nodes may now be displayed in the same table within the Quick Data Access form. Different lines previously displayed in separate tables. Getting all connections in the same table further eases model verification and setup of connections.
- **Display of contact properties in the Quick Data Access:** Contact properties associated with all the analyses may now be displayed in the same table within the Quick Data Access form. Contact properties associated with different analyses previously displayed in separate tables.

- **CTRL + A key** : The CTRL + A keys are now available within every table which eases selection of complete data field and hence make copy/paste much straightforward.

3.2 Changes to lines

- **Number of segments**: The number of segments along a section of line may now be directly input into the Line data form. This improves generation of multiple segments which does not require anymore clicking several times on the Add Segment button.

3.3 Changes to environment

- **Currents with variable heading**: Environment Set components now feature current profiles with variable heading over the water column. Only current profiles with constant heading were previously available within Environment Sets. This improvement is expected to answer analysis requirements for riser systems deployed offshore Brazil.

3.4 Changes to other model components

- **Vessel motion** : A new motion type labelled "None" has been included in the Motion tab which enables specifying that no vessel motion is to be considered.
- **Vessel drag loads** : Vessel drag properties that are generally used to derive current loads may now be based either on the absolute current velocity, low frequency vessel and current relative velocity, LF + WF vessel and current relative velocity, or LF + WF vessel and current plus wave velocity. A new frame has been added in the **Motion** tab for coupled motion response analysis to select which option is to be considered.

3.5 Changes to post-processing

- **DNV code checks**: The material strength is normally specified at room temperature. Possible influence on the material from the temperature needs to be considered at temperatures above room temperature. Temperature de-rating factor was however available for yield strength only. Temperature de-rating factor for the tensile strength has now been included in DNV code checks post-processing parameters.
- **Improvements to post-processing for bounded flexible pipe**: Post-processing of strain and stress in bounded flexible pipe components (the lines defined using Hose segment types) has been dramatically improved and is now much faster than before. This typically reduces the time required to complete a detailed fatigue analysis of bounded flexible riser by a factor of 50.

- **New wave results variables:** New types of results are available within standard post-processing form, which provide the vertical position, velocity and acceleration of any model component with respect to the instantaneous sea-level. Relative position allows identifying whether a component is being submerged by the wave. Relative acceleration and velocity are also expected to be helpful to assess slamming loads.
- **Reaction loads in local coordinates system:** Reaction forces and moments may now be derived based on the local coordinates system. Typical application includes derivation of hang-off loads components expressed using the local coordinates system of a vessel, buoy, or rigid body.
- **Selection of times for dynamic analysis results:** Initial and final times used to post-process time-history and envelop graphs may now be defined based on user-specified number of wave periods. This feature was previously limited to the last wave period. Results could now be extracted over the last N wave periods.
- **Changes to batch post-processing script files:** New keywords have been added to batch post-processing script files which enable setting up optional parameters to specify whether text results files are to be stored, and whether the contents of the DSS simulation files is to be reset before post-processing is performed.
- **Creating batch post-processing script files:** Batch post-processing script files may now be generated directly for a range of analyses. This feature was previously limited to a single analysis. Right-clicking any Analyses Set in the Model Browser and further selecting the Generate batch processing files item from the pop-up menu will create a single script file with post-processing instructions common to all analyses included in the Analyses Set.
- **Optional storage of reaction loads:** Reaction forces and moments were always stored in DTBR binary files once calculated by the FE engine. You may now optionally ask not to save these files in case reaction loads are not of interest for your analysis. De-activating storage of reaction loads can be made through the advanced Calculation Parameters form and will allow saving significant amounts of space on your hard drive.
- **Optional storage of contact loads:** Contact loads and energy were always stored in DTBC binary files once calculated by the FE engine. You may now optionally ask not to save these files in case contact loads and energy are not of interest for your analysis. De-activating storage of contact loads can be made through the advanced Calculation Parameters form and will allow saving significant amounts of space on your hard drive.
- **Display of sea-surface for static analyses:** The sea-surface may now display as a shaded surface within static analyses simulation files. Shaded surface display was previously available for dynamic analyses simulation files only.
- **Export of results statistics in batch mode:** Results statistics common to analyses included in an Analyses Set may now be exported to Excel in batch mode using the Batch Processing form. Export of these statistics could

previously be made only from the user interface. Export of statistics can now be made automatically for all Analyses Sets included in a DSK model file.

- **Export of Zones Study results:** Export of Cyclic Load Cases results to Excel has been improved and is now available using batch commands. Exporting Zones Study results in batch mode now results in Excel files being created for both Extreme and Cyclic Load cases. Export to Excel is also available from the Batch Processing form.
- **Selection of times for Zones Study processing:** Selection of initial and final times used to derive results within Cyclic Load Cases can now be made automatically based on user-specified number of wave periods.

3.6 Changes to the FE engine

The following items list all improvements to the FE solver that are not available yet from the GUI. These improvements may be used by using associated keywords directly in the LOG files.

- **Full QTF for wave drift loads:** Wave drift loads used to be computed through QTF using Newman's approximation. The contents of the hydrodynamic database file has been improved so that full QTF may now be considered for shallow water conditions.
- **Improvements to time-domain integration scheme:** A new option named "Newmark adaptive" has been added into the Calculation Parameters which enables further specifying the time-domain integration scheme data. This option is applicable for coupled analysis only (e.g. mooring analysis) which are generally handled without numerical damping at all. In this case time-stepping will proceed without numerical damping as required unless when convergence issues occur. The time-stepping procedure is then temporarily switched to the standard Newmark scheme with numerical damping until the convergence problem is overcome, which helps avoiding using smaller time-steps.

3.7 Bug fixes

- **Copy/paste of Analyses Sets:** Copy/paste of Analyses Sets might lead to mistaken environmental data being taken into account in the analyses in case the Environment Set associated with the Analyses Set was modified. This problem has been fixed which ensures that environmental data are extracted from the Environment Set are now correctly associated with the Analyses Set.
- **Display of azimuth in Edit Line form:** The azimuth angle reported for information within the Line form might be incorrect on some instances. This has been corrected and the azimuth now actually refers to the angle between the lines ends and the global X-axis.
- **Display of concentrated loads in the 3D View Window:** Concentrated loads displayed incorrectly in the 3D View Window for DSS files. The position of these

loads was not refreshed as required when the component submitted to that load moved.

- **Stokes 5th order wave:** The routines which derive the wave kinematics based on Stokes 5th order theory might under certain circumstances report NAN values causing the analysis to stop. These routines have been modified to fix this problem.
- **Management of license keys for Winch Lines:** Winch line components were protected through a specific license key and was therefore not available to all users. Winch line components should however be available with standard license keys. Protection has therefore been removed to ensure that all users could access this component.
- **Saving friction induced parameter from the Quick Data Access:** The option used to specify whether friction forces shall include associated friction moment was not saved correctly when specified within the Quick Data Access form.
- **Spectral fatigue analysis of bounded flexible risers:** Fatigue analysis based on the spectral method could not take advantage of predefined stress and strain RAO data stored in external DSO files.
- **Restart:** The restart feature has been improved in the FE engine which improves convergence for highly non-linear analysis cases and also increases confidence in the results in case a line is wound around another component with several loops.
- **Multi-linear axial and bending/torsion laws:** Defining multi-linear axial stiffness together with multi-linear bending or torsion stiffness resulted in the axial stiffness not being taken into account correctly. The axial stiffness was set to zero in this case.

3.8 New keywords for the FE engine

The next Tables lists all new keywords and updated keywords within Version 4.5 of the FE engine. Details about these keywords and associated features may be found in the online help of the GUI and in the Keywords Manual.

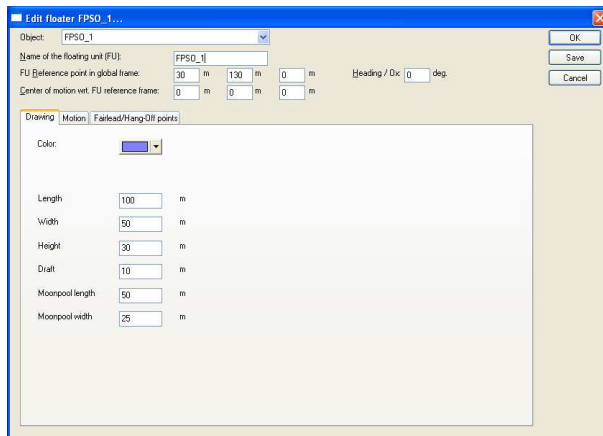
New Keywords & Keywords updated in Version 4.5		
*BARCAIR	*HYDROMESH	*PHYS
*BEAMCAIR	*HYDROMESH, file=	*VIVIL
*DIRLIFT	*INCWIND	*WDD, Name=StructureName
*EIGENVIV	*LFOPTION	*WFOPTION
*FILE64	*MOORLINE	*WIND2
*GRBALLAST	*MULTIENV	*WINDLEVEL
*HYDROCP	*MULTISPEC	

4 Getting help

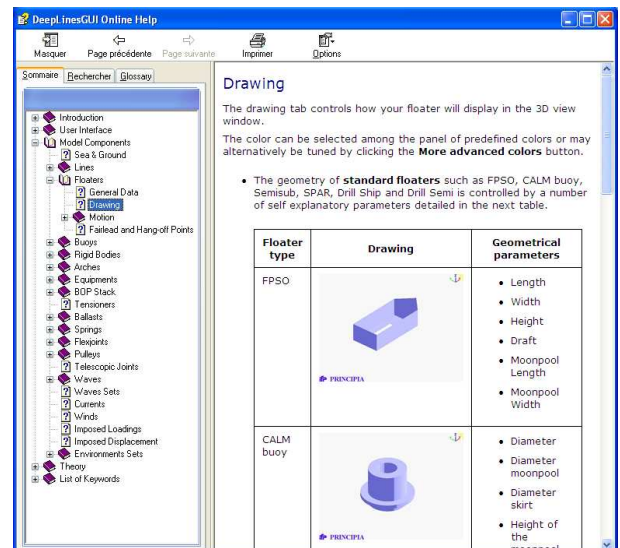
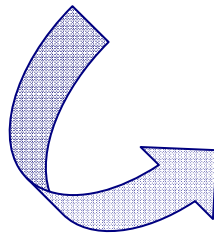
4.1 Documentation & On-line help

The documentation provided with the installation is a good source of information to help you to solve any problem you might experience. Check first the recommendations listed in Section 2.3 "Before you start" of this guide to ensure that the software is properly installed on your system.

When using the GUI, you may access the HTML standard based online help system either through the Help menu or by hitting F1 key to display context sensitive parts from the help.



Hit « F1 » key



4.2 Hotline support

If you do not find how to solve your problem by reading the documentation or online help, we will be pleased to answer your queries.

Our technical support team may help you in troubleshooting your installation or assist with any problem you might have when using the software.

Please contact us by email at deeplines@principia.fr or give us a call at :

- Head office (France) : +33 (0) 4 42 98 11 80
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