wood.

Flexcom

Advanced simulation software for dynamic offshore structures

August 2022

WELCOME

Aengus Connolly
Flexcom Product Manager

I am pleased to announce the release of Flexcom 2022.1. This release incorporates several significant new features, including a new truss element that offers enhanced speed and robustness when modelling structures with low/zero bending stiffness such as mooring lines, and several enhancements for modelling floating offshore wind turbines. Full details can be found in this newsletter.

Consistent with modern software trends, we have adopted a new version numbering system starting from this version. The major number now reflects the year of release, with minor and maintenance numbers having the same significance as previously.

We receive many helpful suggestions from our users and our focus is on delivering new features in the areas where you need them most. We welcome your continued feedback on Flexcom, it is an essential part of our software development process. So please feel free to contact me directly, you will find my contact details below.

We hope you enjoy working with Flexcom 2022.1!

Kind regards,
Aengus

Aengus Connolly
Consultant Engineer
Landline: +353 (0)91 481 238
Mobile: +353 (0)83 158 6728
Email: aengus.connolly@woodplc.com

Follow Flexcom on LinkedIn for the latest news and updates…

Flexcom 2022.1 Highlights

Truss Element

- Specially designed for modelling structures with low structural bending stiffness, such as mooring chains
- Highly robust solution
- Faster computation times due to reduced number of degrees of freedom, and the ability to run at larger time-steps (particularly when lines go slack)

Wind Field Generator

- Allows you to create wind data files which characterise the wind field as a function of space and time
- Acts a user-friendly interface to the TurbSim software which does not have a Windows-based GUI of its own

Flexcom Wind GUI

- Architecture updated to allow a library of components to be built
- Now operates in a similar manner to our DeepRiser software

Soil Modelling

- T-z curves now available
- Analogous to existing P-y feature

Rotational Damper

- Rotational damper now available
- Generates a moment which is proportional to the relative rotational velocity of its end nodes

Display of Element Convected Axes

- Local convected element axes may be displayed in the Model View

Fault Corrections

- Flexcom 2022.1 corrects several program faults identified in the preceding version, Flexcom 8.13.3.

Contents

Software Installation

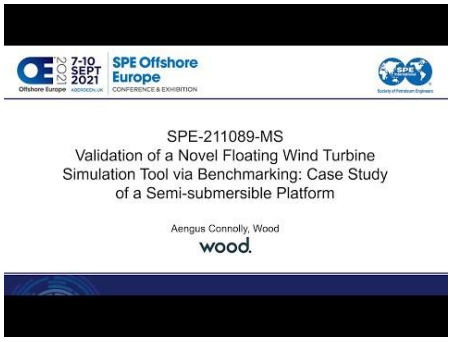
Flexcom 2022.1 is now available for download.

Download Flexcom

Should you have any questions, refer to our Software Installation Guide, or Contact our Support Team.

Join the Flexcom Community!

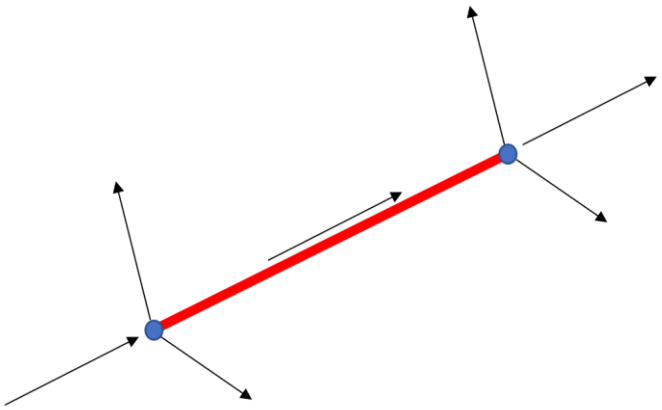
We have over 3,100 followers on LinkedIn and we encourage everyone to sign up. You will find some very interesting videos on the page, such as the one below which contains a recording of a technical presentation from SPE Offshore Europe Conference & Exhibition, discussing the validation of Flexcom for modelling floating offshore wind turbines.



If you have an interesting model which you would like to share with the Flexcom community, please contact us.

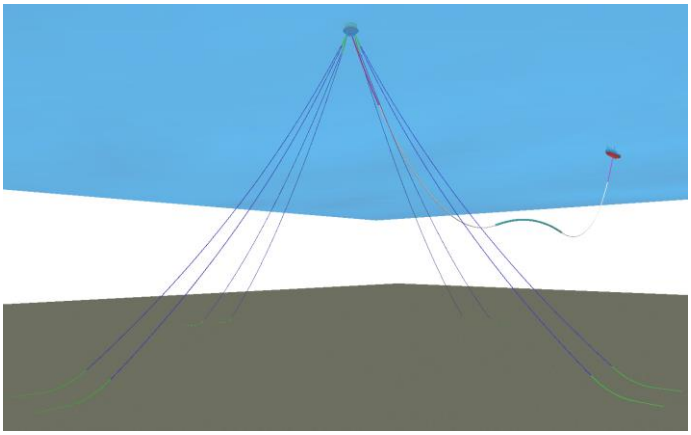
Truss Element

The new truss element is designed specifically for modelling structures which have very low levels of structural bending stiffness (such as mooring chains) and is essentially a simplified version of the standard beam-column element employed by Flexcom. It has 3 translational degrees of freedom at each node and deforms only in the axial direction (it does not deform in bending or torsion). As it does not solve for nodal rotations, the connection at each node is essentially a pure hinge. The axial force penalty term is retained making the truss element a 7-DOF hybrid finite element with two end nodes.



Modelling of flexible lines can be quite challenging, especially in severe dynamic environments, where there is a tendency for the lines to go slack intermittently. Due to the low structural bending stiffness, the standard beam column elements employed by Flexcom are not well suited to this type of scenario. When the beam element attempts to solve for nodal rotations, the lack of bending resistance can lead to solution indeterminacy. In such circumstances, truss elements offer both increased solution robustness and increased computational efficiency. Faster computation times are due to the reduced number of degrees of freedom in the model, and the ability to run at larger time-steps (particularly when lines go slack).

For full details on the finite element formulation, please refer to the online documentation on the Truss Element. If you would like to see an example of truss elements used in practice, we recommend examining the input files for either Example E01 - CALM Buoy or Example L04 - UMaine VolturnUS-S IEA15MW.

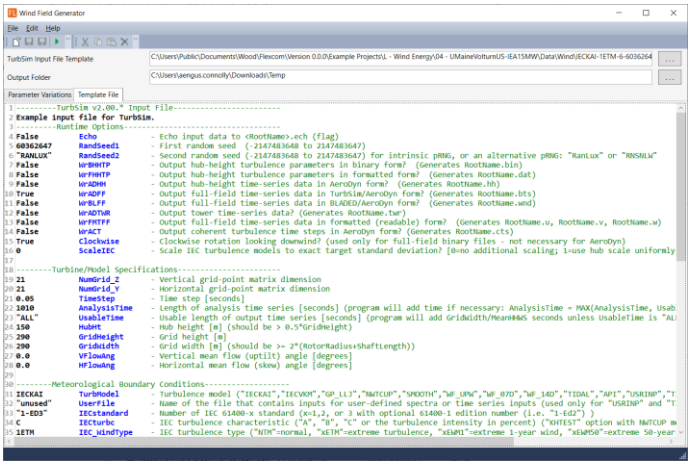


Given the complexity of developing a new finite element formulation, and integrating this into the existing Flexcom software architecture, the new modelling capability has been extensively tested and validated. Contact us if you are interested in reading the verification report.

Offshore Wind

Wind Field Generator

The Wind Field Generator app allows you to create wind data files which characterise the wind field as a function of space and time. It acts a user-friendly interface to the TurbSim software which does not have a conventional Windows-based GUI of its own. It allows you to run batches of TurbSim wind field simulations to generate all the wind data files required to support your design load cases.



Several of Flexcom's wind turbine examples utilise TurbSim binary wind-field definition files. With the file extension BTS (denoting Binary TurbSim), these files tend to be very large, so they are not supplied with Flexcom as it is not practical to include them in the installation package. Instead, you can readily generate the BTS files yourself with the Wind Field Generator app.

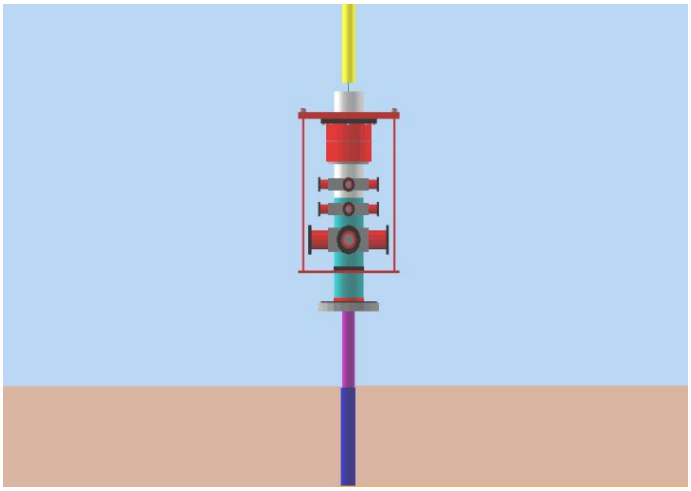
Flexcom Wind GUI

The architecture of Flexcom Wind, our dedicated wind turbine model building tool, has been updated. It now operates in a similar manner to our DeepRiser software, whereby a library of components can be built, and you can pick and choose the components which you wish to include in any individual model. We aim to further expand the model building functionality, which is currently focused on semi-submersible platforms, in the next program release.

Soil Modelling

T-z Curves

Flexcom can now model T-z curves, which are analogous to the P-y modelling feature which has been available for some time. T-z curves represent the soil-structure resistance in the axial direction and are a useful addition for the analysis of top tensioned risers, which typically run through and below the mudline.



Several T-z curves are typically defined over a range of depths below the seabed. Flexcom then applies concentrated stiffness entries to the relevant nodes of the finite element model.

Miscellaneous

In addition to the significant new features documented above, Flexcom 2022.1 also provides several minor and practical additions which contribute to improved user experience.

Rotational Damper

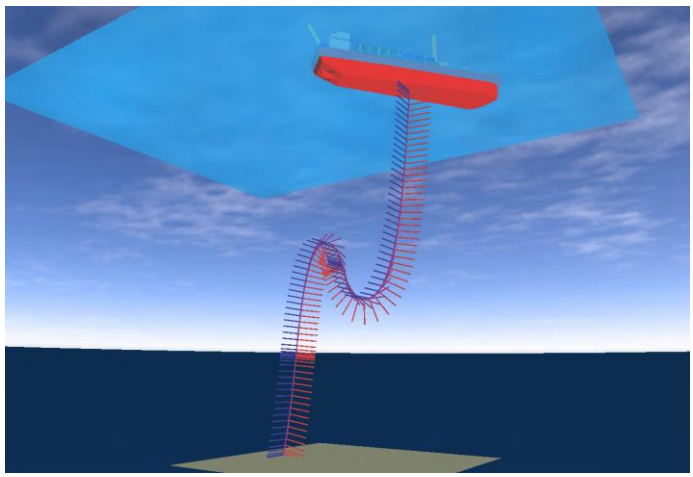
A rotational damper element is now available, in addition to the traditional (translational) damper. It exerts a moment which is inversely proportional to the relative rotational velocity of its end nodes. Specifically:

$$M = -(C_1 v)$$

where *M* is moment, *v* is the relative rotational velocity of the end nodes, and *C1* is the damping coefficient. Sample applications might include simulating torsional resistance on a rotating shaft.

Display of Element Convected Axes in Model View

You can now view the local convected axes for each element in the Model View. By way of background, Flexcom uses a convected coordinate axes technique for modelling finite rotations in three dimensions. Each element of the finite element discretisation has a convected axis system associated with it, which moves with the element as it displaces in space. The image below shows the element CCA display for a sample Flexcom model.



Key: **Purple** is local x-axis, **Red** is local-y axis, **Blue** is local-z axis.

Nodal Motions

Flexcom has traditionally reported nodal motions in terms of absolute positions in space, rather than displacements from original coordinate data. It is now possible to request displacements or positions from database postprocessing (*TIMETRACE) and summary postprocessing (*PARA KINEMATIC).

Standard Examples

The following examples have been modified to illustrate the use truss elements rather than beam elements for mooring line modelling:

- Example E01 - CALM Buoy
- Example L04 - UMaine VolturnUS-S IEA15MW.

Fault Corrections

Flexcom 2022.1 corrects several program faults identified in the preceding version. Refer to the online documentation on Known Software Faults in Flexcom 8.13.3 for full details.