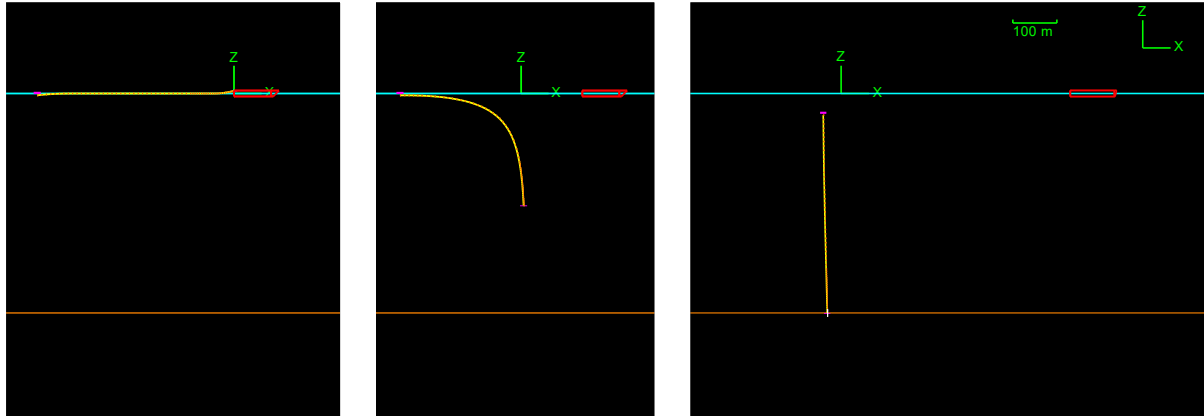# G04 Anchor last deployment

This model shows a method commonly adopted for the deployment of a deep-water oceanographic mooring. The mooring is streamed out behind a moving vessel, with the top end buoy as the first object in the water, furthest from the vessel. When the whole length of the mooring has been deployed, the anchor is tied off at the vessel stern, and the vessel proceeds to the correct mooring position. Without stopping the vessel, the anchor is cut free. The whole mooring then free-falls until the anchor hits the seabed.

The simulation is used to determine the final position of the anchor relative to the vessel's position when the anchor ties are cut. It is also used to determine the tensions in the line.

Note that the mooring line may go slack when the anchor strikes the seabed. If the line is not perfectly torque balanced it is possible for loops and kinks to form in the line. This may lead to early failure of the mooring. This model assumes that the line is perfectly torque-balanced and that the installation is carried out in still water.

Building the model

The mooring is represented by a single line attached between the buoy and the anchor. For simplicity, the buoy and anchor are modelled as 3D buoys but a more detailed model would use 6D buoys. This would allow us to study the pitch and roll motions of these objects and model the surface piercing more accurately if required.

The anchor is attached to the lay vessel using a release link.

Open the *Release Link* data form via the *model browser*. The link is set to release at *start of stage 1*. This is 10 s into the simulation. The release represents the action of cutting the anchor free.

Rather than starting the analysis with the vessel stationary and waiting for it to reach steady state this example includes the steady forward velocity in statics. Open the *general data form* from the model browser and look at the *statics* page. The *starting velocity* has been specified, which models the constant initial forward speed as a current applied in statics.

The *Lay Vessel* motion during the dynamic simulation is specified on the *primary motion* page of the vessel data form. Note that the velocity direction on the *statics* page of the *general* data form is given relative to the global X axis. The direction on the *primary motion* page of the vessel data form can also be specified relative to global X but in this example, it is relative to the vessel

heading instead. OrcaFlex converts the initial dynamic heading so it is also relative to global X and compares it to the static heading. If they differ, then OrcaFlex will issue a warning.

The lay vessel uses OrcaFlex default data, which represents a tanker. There are no waves, and so the motion is unaffected, but if waves were added then actual RAO data for the vessel would be required.

The *Anchor* 3D buoy data form shows a *contact area* and *seabed friction coefficient* have been specified. The mooring does not contact the seabed and the friction coefficient of its line type (*Wire*) is set to zero, see the *friction* page of the line type data form.

Results

Three time history plots are presented.

Two plots are of the mooring *effective tension* at the *Buoy* (top right) and the *Anchor* (bottom right). The changes in effective tension caused by the buoy submerging and by the anchor hitting the seabed are clearly identifiable in the time histories.

The time history of the Buoy *Z* position is shown at the bottom left. The buoy maximum depth is about 47 m, compared with the settled depth of about 42 m. This temporary additional depth is important when choosing the depth rating of the buoyancy unit.

This model runs successfully with the default implicit integration scheme time step, however the iteration count does go quite high right at the start of dynamics i.e. when the anchor is released. This type of transient event can sometimes require you to use a shorter time step. Alternatively, the variable time step scheme could be used, as there is only a short part of this simulation that needs a short time step. The variable time step scheme would automatically adjust the time step in response to what is happening in the simulation and would therefore be an efficient option to use.

However, it should be noted that variable time step schemes can introduce high frequency noise into a system which in turn can lead to inaccurate results e.g. noisy time histories, non-physical spikes in results, etc. This is a feature of all variable time step algorithms. For the majority of systems no problems arise when using a variable time step; however, if you are using variable time steps, then we recommend that you check the quality of your results. Further details about this can be found on the Modelling, data and results | General data | Implicit integration page of the OrcaFlex help.