OrcaFlex Linear Seabed Stiffness Data

Units

The linear seabed model in OrcaFlex has seabed stiffness data that is specified in units of Force per unit penetration, per unit area of contact. For contact of lines on the seabed these units are a bit non-standard, since for line contact the seabed stiffness is often quoted as the force per unit penetration, per unit length of line.

Because of this, if your source of seabed stiffness data gives the value, K_{source} say, as a force per unit penetration per unit length of line, then you will need to divide that value by the line type contact diameter $D_{contact}$ in order to obtain the data value

$$K_{OrcaFlex} = K_{source} / D_{contact}$$

that needs to be entered into OrcaFlex.

When OrcaFlex uses the data, the seabed reaction force on a given unstretched length of line L will be:

$$K_{OrcaFlex} . (D_{contact} . L) . Penetration$$

where ($D_{contact}$. L) is the area of contact used by OrcaFlex. This resulting seabed reaction therefore equals

$$K_{Source} . L . Penetration$$

as required.

Setting Seabed Stiffness to give Expected Penetration

There is often no specific data available for the seabed stiffness data. In such cases the seabed stiffness can be set by adjusting the value until a free length of line lying on a flat seabed gives a sensible penetration.

In the example OrcaFlex data file 'Seabed Stiffness.dat', the line in the model has one end anchored, just touching the seabed, and the other end free, and there are no waves, current etc. If you run the static analysis and then look at the range graph of 'Seabed Clearance' of the line for period 'Static State' then you will see that the line (except at the anchored end) sinks in just under 20mm.

If you replace the line type in this example with your specific line type then you can see how much penetration there is, and then adjust the seabed stiffness until the penetration seems reasonable.

The seabed stiffness is not normally very critical, providing it's not so low that the line sinks in much too far, or so high that simulation convergence is affected. The advantage of the above suggested way of adjusting the seabed stiffness is that one usually has a better feel for how far the line would penetrate than for the more abstract seabed stiffness figure.

We hope that the information in this article is useful, but do contact us if you have any comments or questions.

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