Line statics: Catenary

The catenary method calculates the equilibrium position of the line, but it ignores the effects of bending and torsional stiffness of the line or its end terminations.

The catenary method also ignores contact forces between the line and other objects in the model, but it does include all other effects, including weight, buoyancy, axial elasticity, current drag and seabed touchdown (see below) and friction.

Because bend stiffness and other effects are not included in the catenary method, the position found is not, in general, an equilibrium position. Full statics should therefore be performed in step 2, unless you know that the omitted effects are unimportant. Nevertheless, the catenary position is often quite close to the true equilibrium position, especially when bend stiffness is not a major influence.

The catenary algorithm is robust and efficient for most realistic cases, but it cannot handle cases where the line is in compression. This is because, when bending stiffness is ignored, compression means the line is slack and there is no unique solution. The algorithm is an iterative process: if it fails to converge, OrcaFlex automatically switches to the quick method as a fallback.

The catenary method can allow for seabed touchdown, with the following limitations:

- Seabed touchdown can only be included at the bottom end of the line.
- Touchdown is only included if the bottom end is on or below the seabed. If the bottom end is above the seabed, even if only by a small amount, then no touchdown will be modelled and the line may hang below the seabed. This will be corrected if full statics is selected for step 2, as the nodes below the seabed will be pushed back up by the seabed reaction forces.
- If the bottom end is below the seabed, then the catenary algorithm models touchdown by assuming that the line *levels out* at the level of the end. This will result in part of the line being below the seabed, but again this will be corrected by full statics.