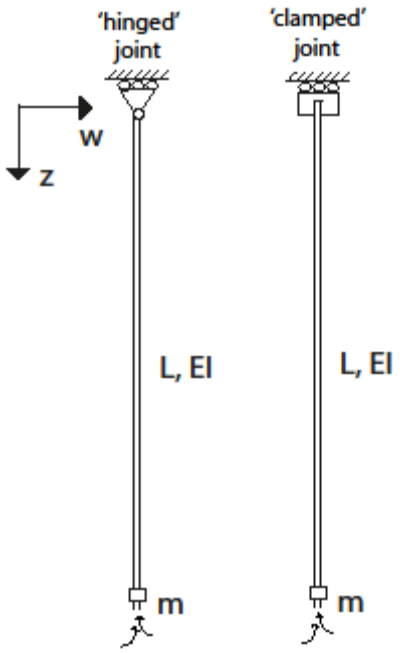
Offshore & Dredging Engineering

Technische Universiteit Delft

Seakeeping Analysis Offshore OTEC Applications

This research is being undertaken at Bluerise B.V. to gain insight into the in-situ dynamic behaviour of various floating Ocean Thermal Energy Conversion (OTEC) systems. The developed model is fully coupled, and takes into account all dependencies of the floating structure, mooring lines and cold water pipe. Such dependencies are, among others, the increase in the tension of the pipe due to the vertical heave motion and the restoring force of the mooring lines on the vessel. The vessel motion is coupled to the mooring system and the cold water pipe via kinematic and dynamic interface conditions. An accurate prediction of the dynamic behaviour of the coupled system is essential for the correct dimensioning of the pipe and in order to define properly the workability conditions and operability levels of various OTEC configurations.



In this thesis the use of frequency domain seakeeping data, obtained from linear diffraction software, is considered to obtain time-domain models in OTEC offshore applications. The time domain behaviour is important for the design of control systems, performing simulations to create insight in the dynamic behaviour of OTEC systems and to determine stresses in the cold water pipe due to non-linear environmental effects.

The convolution term which is present in the time-domain solution is replaced by an equivalent set of transfer functions. By using the transfer function approach, dramatic simulation time savings compared with direct integration of the convolution term are obtained, while maintaining its accuracy when sufficiently high order polynomials are considered due to its Markovian property. The theory described in this thesis can be used for future studies in developing control systems and in optimizing potential OTEC configurations. Control system applications which can be looked into include dynamic positioning, thruster assisted position mooring, roll stabilization, heave compensation and more.

Student
Jeroen van de Sande
February 2nd, 2017

Sponsor
Bluerise B.V.

Thesis committee
Prof.dr. A. Metrikine
Dr.ir. A. Tsouvalas
Dr.ir. K.N. van Dalen
Ir. B.J. Kleute