

Analysis of Elastic Moorings

Development of advanced Seaflex mooring system simulation capability in ProteusDS



Partner:	Seaflex AB
Location:	Umeå, Sweden
Description:	Simulate the Seaflex elastic mooring system and predict its response for marina and offshore applications.
Scope:	Validate the use ProteusDS for simulating Seaflex technology, and build tools to enable rapid design of Seaflex mooring installations.

Dynamic Systems Analysis Ltd.

For over 10 years, DSA has been supporting the ocean engineering industry through the development of custom software solutions for the most challenging dynamic analysis problems. DSA's ProteusDS and ShipMo3D simulation software tests virtual prototypes of vessels and equipment operating in ocean conditions.

DSA creates virtual prototypes of marine structures to answer questions related to engineering design, planning, training, operations, and safety. Understanding the dynamic effects of ocean current, wind, and waves can significantly reduce the risk and uncertainty of vessel motions and loads on equipment in an ocean environment resulting in safer designs and lower risk and project cost.

Seaflex AB

Seaflex AB is the maker of the Seaflex mooring system. The Seaflex mooring system is an engineered mooring system that is custom made for each particular location based on the expected forces and conditions.

The Seaflex elongates and retracts in an even, smooth movement - keeping the mooring platform (e.g. a marina) stable and in position even during bad weather. The unique construction of the system offers unsurpassed dampening of forces which aids in the longevity of the structures it is anchoring. In-house engineers at Seaflex AB help design the best solution for all requirements.

Background

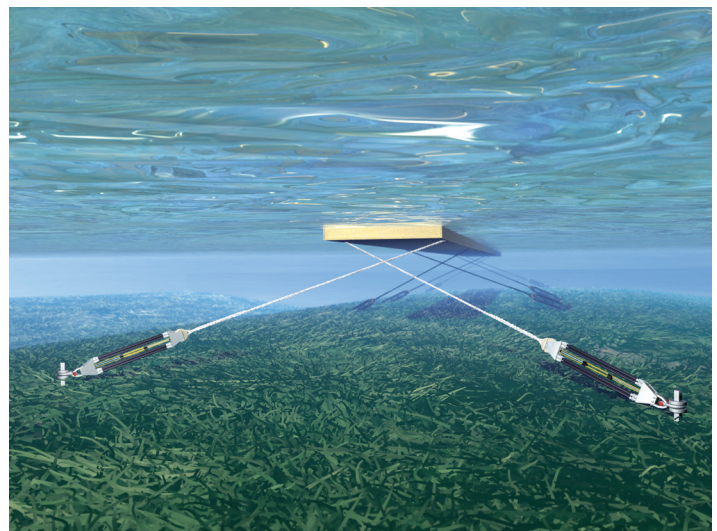
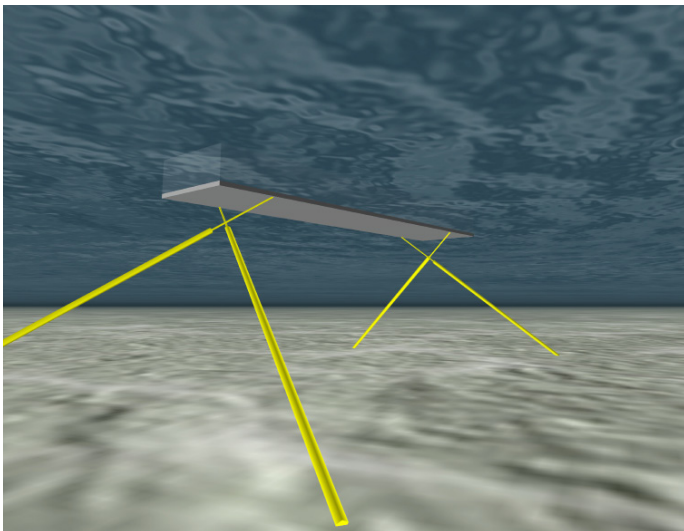
The Seaflex mooring system can be used for many applications including marinas, wave attenuators, navigational buoys, residential pontoons / docks, floating helicopter platforms, seaplane terminals, floating fish farms, floating solar energy parks, floating houses, wave energy converters, and many more.

Designing these systems requires estimating the effect of current, wind, and waves on the mooring. Numerical modelling of the response of the Seaflex mooring system to various conditions is important to de-risk the use of the use of Seaflex technology where chain moorings have been used or to satisfy insurers or engineers' desires to predict the exact response of the mooring installation a priori.

Challenges

The Seaflex mooring technology relies on a viscoelastic rubber hawser with hysteretic axial rigidity characteristics. This means that the load response of the Seaflex units depends on the time history of loading and the elongation state of the hawsers.

This complex phenomenon, while well understood from a conceptual standpoint, can be difficult to represent numerically. Seaflex and DSA have been working together to accurately model the response of Seaflex mooring technology using the ProteusDS line model nonlinear axial rigidity model.



Scope of work

- Implement the Seaflex mooring system model in ProteusDS.
- Develop a software tool that assists users in setting up Seaflex marina simulations.
- Validate the correct functioning of the model, including modelling the yellow ByPass safety system and unique loading and unloading phenomena.
- Provide training on how to use ProteusDS to simulate Seaflex mooring technology.

Outcome

The model was successfully implemented, and the response of the Seaflex system can now be predicted using the full capabilities of the wind, wave, and current models in ProteusDS. The Seaflex team has the capabilities in-house to model a wide range of applications and has access to support from the DSA team for all of their projects.