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Spar model in dedicated VIM set-up for efficient model rotation.

As MARIN extends its model testing to the field of truss Spars, tests show that both the choice of mooring system and current profile can have a significant influence on the VIV response.

Specialised tests for Spar optimisation

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Over the past two years MARIN has extended its model test experience to the field of truss Spars with several model test programmes being carried out on truss Spars to evaluate the Vortex Induced Vibrations (VIV) and to optimise the strake configurations.
The results of these model tests suggest that modelling details can have a profound influence on the VIV response. In order to reliably predict the VIV of the prototype Spar these details must be accurately represented on the model. Details include strakes, caissons, fairleads and mooring chains. Roughness is typically added to the model to minimise scale effects due to the shift in Reynolds number at model scale. In addition, damping of attached structures such as the truss on a truss Spar can significantly contribute to the reduction of VIV.

Tow tests

MARIN has numerous tow tank facilities where Spar VIV tow tests can be conducted, including towing in the presence of waves. MARIN's Depressurised Towing Tank (240 x 18 x 8 m (L x B x D)) is especially suited for VIV testing due to its long tow length and large cross section.
Uniform current flow is simulated by towing the Spar model in otherwise calm water. A typical test programme consists of a large number of tow tests at different headings. For each heading a range of tow speeds are tested to cover all possible current speeds and directions.

Significant influence

The VIV model tests are normally carried out using an equivalent horizontal mooring system. MARIN has also conducted model tests on a truss Spar to investigate the effect of the mooring system and the applied current profile on VIV response. These tests included applying uniform and sheared profile in a wave basin with the Spar held in place by a spread mooring system. Results of these tests were compared with towing the same Spar in a tow tank with an equivalent horizontal spring system. The results of these tests show that both the choice of mooring system and current profile can have a significant influence on the VIV response of the Spar.

Further information and results on the topic of Spar VIV model tests can be found in the following papers:

- OTC2003 - 15242, "Model Tests Experience on Vortex Induced Vibrations of Truss Spars", R.R.T. van Dijk, MARIN; A.R. Magee, Technip Offshore Inc.; S. Perryman, BP; J. Gebara, Technip Offshore Inc.
- OMAE2003 - 37151, "The Effect of Mooring System and Sheared Currents on Vortex Induced Motions of Truss Spars", R.R.T. van Dijk, A.J. Voogt, MARIN; P. Fourchy, Murphy Oil Corp; S. Mirza, Agip Petroleum Inc.