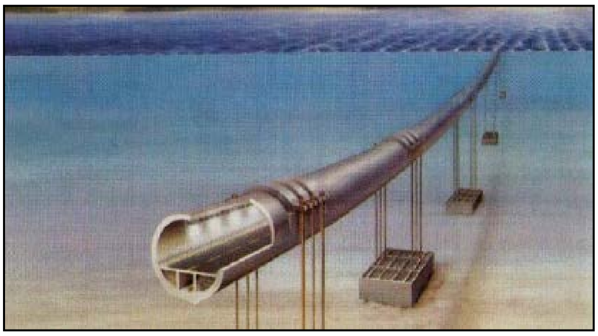
Technische Universiteit Delft

Offshore & Dredging Engineering

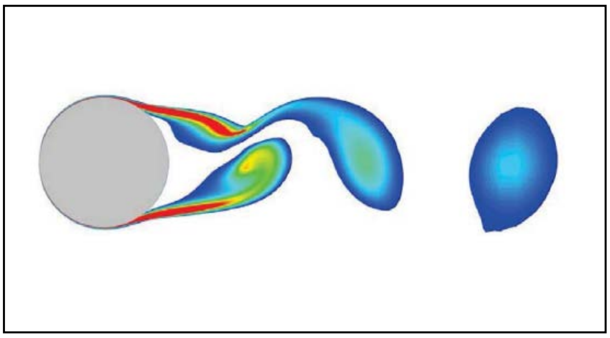
Structural response of a submerged floating tunnel induced by current flow

A submerged floating tunnel (SFT) is a concept that has been investigated quite thoroughly in the past, but has never been built till now. A tube is placed underwater, around 20-50m depth, anchored to the seafloor or restrained with pontoons in order to avoid water traffic and wave forces at the surface, as well as high water pressures in larger depths.

It is well known that when a cylindrical structure is put inside a fluid flow, periodic motions are induced on the body, created by their interaction. These motions are called Vortex Induced Vibrations (VIV's) and in the offshore industry are mainly caused by currents. Significant forces can arise due to VIV's, which can endanger the structural integrity of the SFT.



Hogsfjord project



Fjeld,2013

The objective of the present Master thesis is to numerically investigate the static and dynamic load effects acting on a tether-stabilized SFT. Focus has been put on capturing the Vortex-Induced Vibrations generated on the structure, when interacting with a current flow. The primary goal is to identify, analyze and evaluate the risks that are considered likely to initiate hazardous events or hazardous conditions in a high risk structure, such as the SFT, and propose measures or design principles/constraints to avoid the identified risks.

A 3D model of the structure has been developed, for this reason. The significance of VIVs is captured, governed by the unsupported free-span length of the tube, as well as the possibility of a progressive failure when one tether unexpectedly fails.

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