

Fluid-Structure Interaction (FSI) of Aquaculture Net Cages



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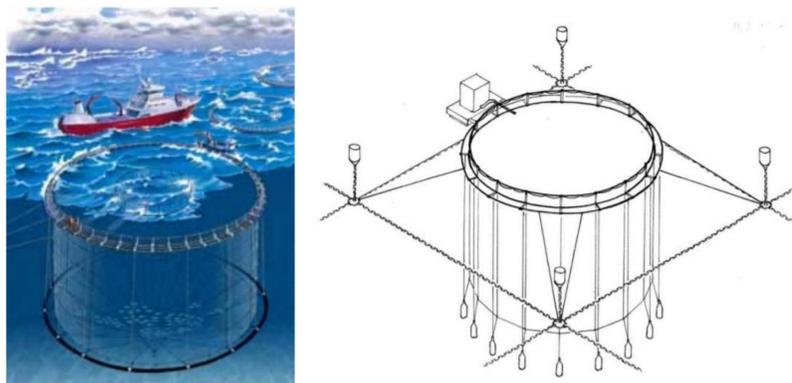
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Abstract

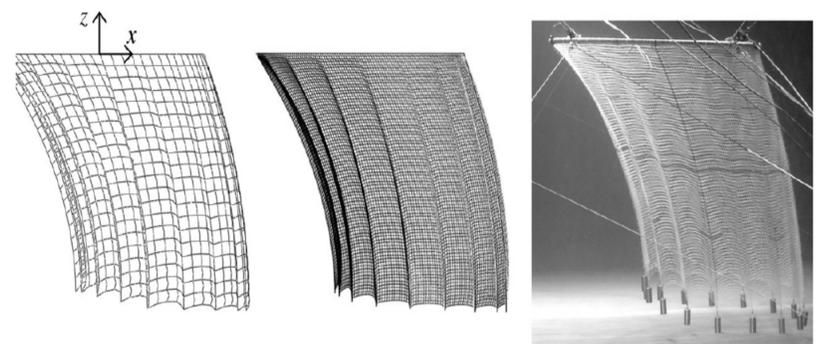
The number of good sites in less exposed locations for aquaculture farming is limited. Trends are now that the fish cages are increasing in both width and depth as well as more weather-exposed locations, are taken into use. As the net cages continue to increase in size, so does the material costs. The design of the sea cages should be modified for safe and reliable use in remote offshore locations. Fish farms located in more exposed areas will be subject to more energetic waves and stronger currents, which will cause large net deformations. This is a challenge as fish welfare depends on a certain minimum volume within the net cage. Changing and maintaining net cages are some of the main expenses for fish farms. If the lifetime of the net cages is extended by introducing stronger, longer lasting materials, the overall costs of the nets will be reduced.

The traditional nets are produced in nylon, while the promising solid PET-wire has been introduced to the aquaculture industry. In this paper, we introduce polyurethane to the aquaculture net cages, which will be studied together with nylon and PET-wire. The study is carried out using fluid-structure interaction (FSI) simulation, computational fluid dynamics (CFD) weakly coupled with structure mechanics (FEM). ANSYS® software is employed in the study. We will look at the materials that show the most promising results for aquaculture purposes.

Off-shore Fish Cages

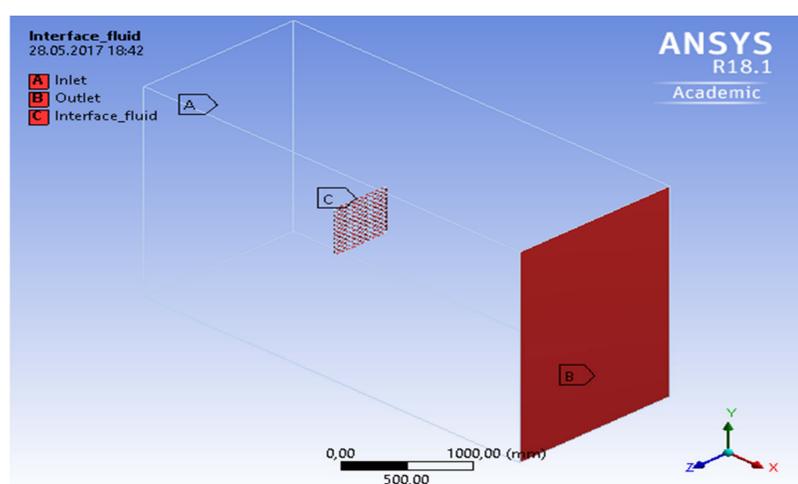


Off-shore Fish Cages under heavy Current*

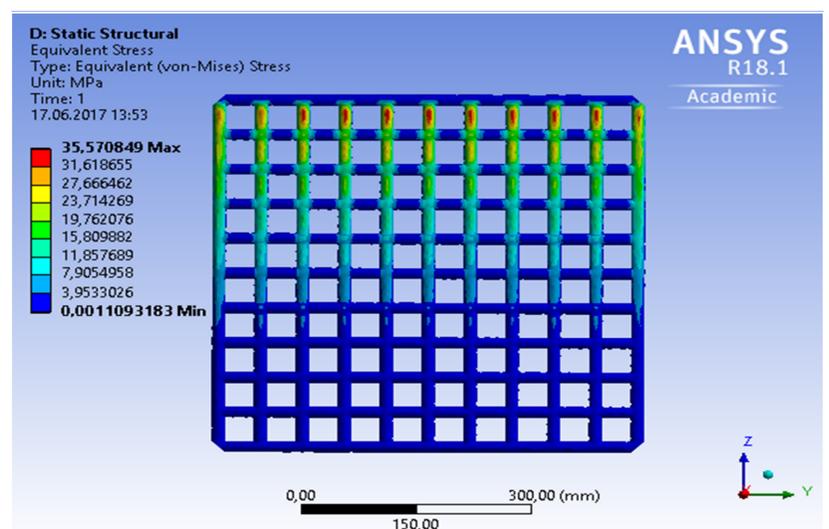


*Moe, H., A. Fredheim, and O.S. Hopperstad. Structural analysis of aquaculture net cages in current. *Journal of Fluids and Structures*, 26(3) 2010; 503-516].

Fluid-Structure Interaction (FSI) Model – ANSYS®



Equivalent Stresses in the FSI Model – ANSYS®



Conclusion

Current used materials such as Nylon PA6 and PET-wire have suitable strength to meet the requirement of fish net cages. Material such polyurethane is a good candidate, however, lifetime performance study is required. FSI proved to be a reliable method for the study of fish net cages, however, found to be computationally intensive.

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