

Comparison of Computational Fluid Dynamics and Potential Theory Approaches to Model Hydrodynamic Loads on offshore structures

In recent years, offshore structures are becoming more and more complex in shape and design. Therefore, the question about whether Potential Theory approaches are still reliable and applicable for these new designs is becoming a challenging question. Computational fluid Dynamics (CFD) method is another powerful option to model the hydrodynamic loads on floating wind turbines. CFD methods which are based on solving Navier-Stokes equations, if properly solved, can capture nearly all the nonlinear hydrodynamic loads on an offshore structure and will lead to very precise results, but it demands very high computational cost and time and there are still some questions on the reliability of current results for practical applications in offshore industry. Potential theory approaches are very reliable and require much less computational time and cost but have difficulty in modeling nonlinear hydrodynamic effects. In the current research the hydrodynamics loads on different offshore structures such as Tension leg platform floating wind turbine and STC concept are estimated by using both CFD and potential theory methods and the results are compared. The CFD method is based on solving Navier-Stokes equations in time domain for the fluid flow (water and air), using an immersed boundary method to capture the platform motion, and level set method for modeling the free surface waves. The potential theory results are from the well verified SIMO/RIFLEX code which uses a second order potential theory approach for estimation of hydrodynamic loads. This investigation will lead to better understanding of our knowledge of hydrodynamic loads on offshore structures especially for high order nonlinear loads.