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NUMERICAL SIMULATION OF A VERTICAL AXIS TIDAL TURBINE USING IMMERSED BOUNDARY METHOD

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The simulation of moving bodies by means of Computational Fluid Dynamics is utterly challenging and requires sophisticated numerical schemes. The major challenge is to simplify, or avoid altogether, the need of re-meshing at every time step and the allocation/interpolation of variables. The Immersed Boundary Method (IBM) is a method that simplifies this procedure allowing the fluid flow to be solved in a fixed Cartesian mesh that does not change along the time. In the IBM, the non-mesh-conforming, moving, solid boundaries are treated as a bunch of Lagrangian points and appropriate boundary conditions are applied to satisfy the no-slip condition of the immersed structure on the Cartesian fluid grid.

In this research, the IBM is applied to carry out 2D Large Eddy Simulations of a rotating vertical axis tidal turbine. By imposing a certain rotational velocity and geometry (using a determined airfoil profile), the simulation allows us to calculate the produced torque of the turbine. The method is validated by comparing simulation results with experimental data. Furthermore, successful validation allows us to study in great detail fluid-mechanical details of the complex fluid structure interaction of tidal turbines. Details of our simulations and latest results will be presented at the conference.

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