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# Numerical simulation of offshore wind turbines using anisotropic mesh adaptation

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Offshore wind turbines are today increasing the potential of wind energy, and numerical simulation is a way to help this industry reach maturity. In the context of floating wind energy, predicting the loads applied on structures and their response is essential. Those data will enable an optimization of floaters dimensioning, necessary for CAPEX reduction.

As the simulation of floating wind turbines requires the representation of both complex geometries and phenomenas, several alternative techniques have been developed. The wake generated by the rotor can be modeled using methodologies inherited from onshore wind turbines simulation, and coupled with a hydrodynamic code. However those simplified methods have been primarily developed for wake study, and thus have varying precision for loads estimation.

This work proposes a methodology for the simulation of one or several turbines with an exact representation of the geometries involved, targeting an accurate evaluation of loads. The software library used is ICI-tech, developed at the High Performance Computing Institute (ICI) of Centrale Nantes. A monolithic approach is applied on a single computational mesh, where all the different phases are defined through level-set functions. The Navier-Stokes equations are solved in the Variational MultiScale (VMS) formalism using stabilized finite elements. This approach, coupled with an automatic and anisotropic adaptation procedure, guarantees the good representation of the geometries immersed. The automatic adaptation refines the mesh only in interest zones, allowing the simulation of phenomena with very different orders of magnitude, e.g. aerodynamics around blades and waves propagation. The reduction of the number of points in the mesh and the massive parallelization of the code are also necessary for wind turbine simulation.

This has been realized within the EOS project scope, funded by WeAMEC (West Atlantic Marine Energy Center). Wind turbine representation and flows are presented.

## REFERENCES

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