# A hybrid high and low dimensional approach for wind and ocean wave energy converters.

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We present a numerical method to solve fluid flows with interfaces like fluid structure interactions. The incompressible Navier-Stokes equations are discretized on Cartesian grids coupled with immersed boundary and level set methods. Several applications will be presented starting from 2D fish like swimming to 3D power extraction like a Wave Energy Converter and windtubines. The CPU costs required for these kinds of applications can be prohibitive. Indeed, large computational domains have to be used due to complex outflow boundary conditions. We thus present a method where boundary conditions are given by a low dimensional model (based on Proper Orthogonal Decomposition Reduced Order Models) that allows to use significant smaller computational domains. This hybrid high and low dimensional approach finally allows to concentrate efforts (high dimensional computations) where accuracy is needed (near obstacle boundaries) and to approximate the solution on a robust POD basis (computed offline) elsewhere.