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Wave relaxation zones in fluid-object interaction problems using EdgeCFD

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A problem of main interest in offshore engineering is the load on ships and platforms caused by waves. The load caused by water on FPSO's deck, known as green water loads, can cause serious damage to the structure and the equipment. To measure and predict such damages, a careful analysis of wave's impact must be done by means of prototyping or numerical simulation. In the case of the latter approach, modeling an open sea condition on bounded computational grids poses the need of a special treatment on the boundary conditions, mainly on the outflow. One of such techniques is known as wave relaxation [1]. It consists on defining a relaxation zone previous to the outflow boundary where the fields involved on the computations are damped by suitable chosen functions. We present results of such technique implemented on the in-house software, EdgeCFD, a residual based variational multiscale (RBVMS) and edge-based finite element incompressible two-phase flow solver [2,3]. We explore two open parameters, namely, the length of the relaxation zone and the relaxation function used to have an acceptable elimination of waves reflections. Then, we show results of such approach applied to a fluid-object interaction problem of interest, the estimation of loads on a FPSO deck subject to different wave types and the calculation of the pressure field, fundamental to the evaluation of buoyancy forces on the FPSO.

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