

Wave-current generation with OpenFOAM. Application to coastal and offshore structures

Javier L. Lara, Gabriel Barajas, Maria Maza, Inigo J. Losada

Environmental Hydraulics Institute "IH Cantabria". Universidad de Cantabria. C/Isabel Torres n°15 Parque Científico y Tecnológico de Cantabria, 39011 Santander (Spain) email: lopezjav@unican.es

Ocean waves and current flows (mainly tidal flow) exist simultaneously in natural environments. The interaction between waves and a current flow has attracted great attention from science and industry, as it plays an important role in sediment transport, seabed stability and in the interaction of waves and current flows with structures in the marine environment. The motivation of the present work is focus on the development of a new set of boundary conditions to generate simultaneously wave and current in OpenFOAM. The new development has been made taking advantage of the experience obtained with the development of IHFOAM (ihfoam.ihcantabria.com) tool to generate and absorb waves at the numerical domain boundaries. The new implementation allows, not only generating simultaneously waves and current, but also absorbing simultaneously outgoing waves and current at the boundaries. It is advantageous with respect to the use of artificial damping regions used by other OpenFOAM developments for waves and currents, as it does not increase the computational domain, and subsequently, reducing the computational cost. The new set of boundary conditions, inserted in IHFOAM tools, will increase the capability of OpenFOAM software to be use as a reliable tool to accomplish more complex designs by means of the use of more realistic boundary conditions for ocean flows. During the presentation, numerical model validation with experimental data and detailed analysis of wave flow interacting with fixed (see figure 1) and floating structures subjected to waves and currents will be shown.

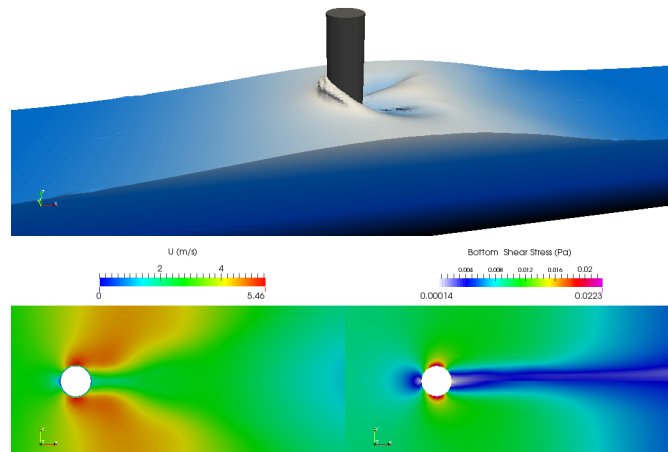


Figure 1. Wave ($H=2$ m and $T=8$ s) and current (2 m/s) interacting with a cylinder