Performance assessment of numerical modelling for hydraulic efficiency of a grated inlet

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Abstract

A performance analysis of the CFD platforms FLOW-3D is presented, focusing on a 3D turbulent flow: a hydraulic efficiency of grated inlet at low and high Reynolds number. Turbulence is treated using RANS approach as RNG k-ε and k-Omega. A Volume of Fluid called VOF method is used with multiphase flow between air and water with Eulerian approach. The numerical model was developed through the software Flow 3D using a structure mesh with Hexahedron cubic in order to reproduce an experimental platform in real scale for the analysis of surface flow and the hydraulics of a grated inlet [1]. The simulation domain was composed by 850583 cells elements that represent the platform and the grate in real scale.

The CFD code FLOW3D allows to performance the hydraulic behaviour of the grated inlet with similar results respect to the data obtained experimentally. In conclusion, the simulation proposed can be used to estimate the efficiency of grated inlets that were not tested in the laboratory. The advantage of this model is the use of hybrid shallow water 3D simulation and nested model between 3D and 2D block mesh. The turbulence model chosen was Re-Normalization Group (RNG). The simulation was performed in a computer Intel Core 2 Duo, 2.3 GHz and 12 GB RAM and the average time of simulation was around 3 days.

Experimental campaign was performed in the laboratory of hydraulics of the Technical University of Catalonia using Surface Flow Image velocimetry (SFIV) techniques capable to reproduce the field velocities around the grated inlet [2].

References

[1] M. Gomez, J. Recasens, B. Russo, E. Martinez-Gomariz (2016). Assessment of inlet efficiency through a 3D simulation: numerical and experimental comparison.

[2] J. Tellez, M. Gómez, B. Russo, J.M. Redondo, (2016). Surface Flow Image Velocimetry (SFIV) for hydraulics applications. 18th Int. Symposium on the Application of Laser Imaging Techniques in Fluid Mechanics, Lisbon, Portugal.