6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

PERFORMANCES OF TWO OPEN-SOURCE SOLVERS IN THE NUMERICAL SIMULATION OF SYNTHETIC JETS

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Keywords: *Synthetic Jets, Solver Efficiency, Nek5000, OpenFOAM*

Synthetic jets are fluid mechanical devices employed in several technological applications, such as flow control, electronic cooling, jet vectoring, and many others. The realization of a synthetic jet requires the design of an actuator which is capable of generating a periodic alternation of fluid ejection and suction from a cavity. A thorough understanding of the flowfield of the synthetic jet issuing in an external environment is essential to properly calibrate the device for the relevant application. In recent years, massive experimental and computational efforts have been made to this end. Overall, a wide variation in the results has been observed and it is not clear which specific technique and modelling approach are the best suited in predicting the flow behaviour.

Incompressible direct numerical simulations of synthetic jet fields generated in a quiescent environment performed by two widespread open-source Computational Fluid Dynamics (CFD) codes, Nek5000 and the OpenFOAM solver *pimpleFoam*, are reported in this work. While the former employs a high-order spectral-element method, the latter is based on finite-volume, lower-order schemes. The two experimental cases described in Smith & Glezer (1998) and Yao *et al.* (2006) are basically analysed. A reasonably simplified geometry of the device is adopted, whereas the flow non-dimensional parameters of the simulations match the experiments. Results are generally in good agreement with the experimental data, in terms of first- and second-order moments of the long-time and phase-averaged velocity fields. Other fundamental quantities, such as the celerity of the vortices expelled from the cavity orifice, are analysed. The performances of the two codes are compared thoroughly, with regard to accuracy as well as computational cost.

The present computations show that Nek5000 is globally more efficient than *pimpleFoam* for the problem under study.

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