Detailed vortex shedding flow formation on complex geometries

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Resumo

In this paper, the Immersed Boundary method is applied for simulating three-dimensional flow inside of complex geometries with high Reynolds numbers using an adaptive parallel strategy for space and time discretization. The method is based on the immersed boundary method of Wang, Fan e Luo (2008) which uses the direct formulation of fluid-solid interaction force. The spatial discretization of the Eulerian domain is based on the SAMR strategy of Berger and Colella (1989) where a projection method is employed for solving the Navier-Stokes equations, and the time integration algorithm is based on the IMEX scheme. To validate this algorithm, the study of flow past a sphere is detaield for several different flow regimes: steady-state laminar flow at a Reynolds number of 100, time-dependent laminar flow at Re=300 and turbulent flow at Re=10000. The use of adaptive mesh refinement strategies led to physically detailed results with low computational cost compared with a uniform mesh. For numerical simulation of turbulence the Large Eddy Simmulation is used. In LES modelling the contribution of the large, energy-carrying structures to momentum and energy transfer is computed exactly, and only the effect of the smallest scales of turbulence is modeled. As an apllication of theses numerical capabilities, a flow inside a complex structures with a set of tubes and valves is shown for a Reynolds of $4 \cdot 10^6$, as well as, the vortex shedding detaield of a flow past a sphere.

Referências

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