Anisotropic boundary layer mesh generation for immersed complex geometries

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ABSTRACT

We propose a new anisotropic boundary layer mesh adaptation procedure for immersed geometry. It is based on the use of multi-levelset method to locate the boundary layer, to control the mesh size distribution, shape and orientation ensuring a smooth gradation. Taking into account the physical parameters for the simulation and the curvature of the geometry, the numerical 2D and 3D applications show that, starting from an arbitrary coarse domain, it provides accurate representation of the immersed interfaces and their boundary layers for complex geometries. More specifically, when the solution displays anisotropic behaviour, we combine it with an edge based error estimator and dynamic anisotropic mesh adaptation to detect automatically all flow features under the constraint of a fixed number of elements. Some applications in aerodynamics at high Reynolds number for the prediction of the drag and lift coefficients [1] as well as complex gas-solid-liquid flows [2] will be presented. The proposed method is robust and simple to implement. It was validated using several test cases from the literature and some experimental results.

REFERENCES

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[2] M. Khalloufi, Y. Mesri, R. Valette, E. Hachem, High fidelity anisotropic adaptive variational multiscale method for multiphase flows with surface tension, Computer Methods in Applied Mechanics and Engineering, Vol. 307, pp.44-67, 2016