Parallel anisotropic mesh adaptation with DMPlex and Pragmatic

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ABSTRACT

Anisotropic mesh adaptation is still rarely found in industrial numerical simulation software, despite its proven efficiency to improve the precision of simulations while reducing their CPU cost [1]. We believe that the difficulty to integrate it to existing packages is one of the main reasons for this. Besides, as the trend is to use numerical solvers on increasingly large supercomputers, the robustness of anisotropic (re)meshers on such architectures is still to be demonstrated.

The approach presented here is to integrate Pragmatic, an anisotropic mesh adaptation library, into DMPlex, the unstructured mesh management object defined and used in the well-known numerical solvers library PETSc [2]. As PETSc is already widely used, this will make anisotropic mesh adaptation available to a much larger community. DMPlex, through PETSc, is aimed at massively parallel applications. Pragmatic [3] was also designed to run efficiently on parallel architectures. In this talk, we will explain how the different stages of the adaptation process are parallelized.

We will present proofs of concept of this integration with three-dimensional test cases, such as the advection of a bubble presented in Figure 1.

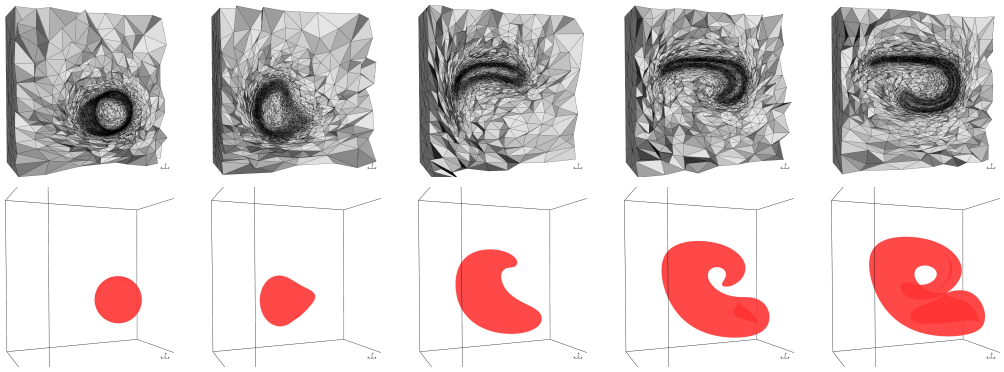

Figure 1: Cuts in the mesh (top) and isosurfaces of the solution (bottom) at dimensionless times $t = 0, 0.24, 0.54, 0.84$ and 1.5.

REFERENCES

[1] F. Alauzet and A. Loseille. A decade of progress on anisotropic mesh adaptation for computational fluid dynamics. *Computer-Aided Design*, Vol. **72**, pp. 13–39, 2016.

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