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ANISOTROPIC MESH ADAPTATION BY VERTEX REALLOCATION

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Abstract. Mesh adaptation is widely used to solve Computational Fluid Dynamics (CFD) problems both on structured and unstructured meshes. It allows to improve the accuracy of the numerical solution while keeping bounded the usage of computational resources. Error reduction in the finite element solution is attained more efficiently by using anisotropic mesh adaptation than by isotropic one if the problem solution is anisotropic in nature. This usually happens in compressible flow problems with shock waves, contact discontinuities and wakes. In this work we propose an anisotropic unstructured mesh adaptation strategy that reallocates the vertices of the mesh (r-adaptation). Vertices are moved in accordance to a metric map induced by the Hessian of the numerical solution. The Hessian matrix is recovered by a double projection approximation of the finite element solution while weighted extrapolation is used at the boundary of the domain. The strategy is first evaluated for tipical test cases on triangle meshes in order to compare the computed solutions to analytical ones. Then, typical gasdynamic benchmarks for compressible flow problems are solved and the numerical results from other authors are considered as reference.