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Minimizing finite-volume discretization errors on polyhedral meshes QUENTIN MOULY, FABIEN EVRARD, BEREND VAN WACHEM, FABIAN DENNER, Imperial College London — Tetrahedral meshes are widely used in CFD to simulate flows in and around complex geometries, as automatic generation tools now allow tetrahedral meshes to represent arbitrary domains in a relatively accessible manner. Polyhedral meshes, however, are an increasingly popular alternative. While tetrahedron have at most four neighbours, the higher number of neighbours per polyhedral cell leads to a more accurate evaluation of gradients, essential for the numerical resolution of PDEs. The use of polyhedral meshes, nonetheless, introduces discretization errors for finite-volume methods: skewness and non-orthogonality, which occur with all sorts of unstructured meshes, as well as errors due to non-planar faces, specific to polygonal faces with more than three vertices. Indeed, polyhedral mesh generation algorithms cannot, in general, guarantee to produce meshes free of non-planar faces. The presented work focuses on the quantification and optimization of discretization errors on polyhedral meshes in the context of finite-volume methods. A quasi-Newton method is employed to optimize the relevant mesh quality measures. Various meshes are optimized and CFD results of cases with known solutions are presented to assess the improvements the optimization approach can provide.

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