New quality measures for quadrilaterals and new discrete functionals for grid generation

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ABSTRACT

Many authors have observed that the effect of the mesh geometry on the accuracy of the numerical solution of a P.D.E. depends on several factors. In structured and unstructured meshes, it has been found that the non-uniformity of the mesh can increase truncation errors and decrease the order of convergence of a scheme. Different studies [1, 6, 9, 8] show the importance of non-orthogonality, mesh size variation, obliqued and aspect ratio, quantities that play a major or minor role depending on the problem and the solution method.

In this talk, we review some quality metrics [3, 7, 5] and define some new quality measures for quadrilateral elements. Usually, the quality (shape) measure is a quantity inverse to the energy density; maximum of such a quality measure corresponds to the minimum of the energy density over the grid [4].

We also define new discrete functionals implemented in an optimization-based method for quadrilateral grid generation and improvement. These functionals are combined with a discrete functional with an infinite barrier at the boundary of the set of unfolded grids like $S_{ω,ε}(G)$, see [2], in order to preserve convex grid cells in each step of the optimization.

REFERENCES


