ROBUST PARALLEL ALGORITHM FOR ANISOTROPIC ADAPTIVE TETRAHEDRAL MESHES

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Nowadays the great number of engineering computations rely on ability to generate meshes adapted to solution variations. It has been shown in a number of papers that elements with obtuse and acute angles stretched along the direction of minimal second derivative of a solution may be the best elements for minimizing an interpolation error. As the result, an optimal adaptive mesh may frequently contain anisotropic elements.

In the talk, we discuss a robust parallel algorithm for generation adaptive anisotropic tetrahedral meshes. The algorithm is problem independent and is based on a black-box Hessian recovery technique. It produces a mesh which is quasi-uniform in a metric field generated by the discrete Hessian recovered from the discrete solution. A measure of the mesh quasi-uniformity defines a mesh quality. Starting with a lower quality initial mesh, the algorithm improves the mesh quality by a sequence of local operations. The list of local operations includes moving, adding and deleting mesh nodes, and swapping of mesh edges and faces.

We shall also mention a few new theoretical results showing that the grid generated by our algorithm is quasi-optimal in a class of grids with the *a priori* bounded number of elements. It means that the best interpolation error in this class of grids is bounded by the interpolation error on the quasi-optimal grid times a constant depending only on the mesh quality.

The local nature of the algorithm is very suitable for different conceptions to its parallelization. Our strategy is based on an inertia bisection method which appeared to be very efficient for unstructured grids. The initial grids is split into a few approximately equal parts by planes parallel to the principles directions of an inertia tensor associated with the mesh. The arithmetical scalability, parallel efficiency and robustness of the algorithm will be demonstrated by a few problems including anisotropic singularities, boundary layers and strongly varying coefficients.

References

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