Mesh grading of triangulations generated by adaptive bisection

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Adaptive mesh refinement algorithms such as the 2D newest vertex bisection and its generalisations to higher dimensions by Maubach and Traxler are an essential part of adaptive finite element methods. As intended, this generates triangulations with locally varying mesh size, i.e., the meshes are graded.

The L^2-projection mapping to the continuous Lagrange finite element spaces is an important tool in numerical analysis. For parabolic problems it is known that its stability properties in Sobolev spaces are the key to discrete stability and quasi-optimality estimates. However, its stability properties depend on the grading of the underlying triangulation, and for this reason such grading properties are of particular interest.

Previously, only grading properties for 2D mesh refinement schemes have been obtained and in higher dimensions the corresponding results are much more challenging.

We present optimal results on the grading of families generated by the adaptive bisection algorithm by Maubach and Traxler for arbitrary dimensions. Those sharpen previous results in 2D and are the first results in higher dimensions. Furthermore, we discuss the implications on Sobolev stability of the L^2-projection.

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