# STABILITY PROPERTIES OF THE $L^2$-PROJECTION MAPPING TO FINITE ELEMENT SPACES

L. DIENING, J. STORN, T. TSCHERPEL*

Abstract

The $L^2$-projection mapping to Lagrange finite element spaces is a crucial tool in numerical analysis. Its Sobolev stability can be interpreted as the preservation of an energy. For parabolic problems it is known to be the key to discrete stability and quasi-optimality estimates.

For adaptively generated meshes the proof of Sobolev stability is challenging and restrictions on the mesh grading are unavoidable. We present results on $L^p$ and $W^{1,p}$-stability in 2D and 3D for any polynomial degree and for any space dimension under suitable conditions on the mesh grading. Additionally, we discuss grading estimates for widely used adaptive refinement schemes including the newest vertex bisection.

* Department of Mathematics, Bielefeld University (Germany)
ttscherpel@math.uni-bielefeld.de