Elliptic Neumann Boundary Control Problems: FE Error Estimates for Quasi-uniform and Graded Meshes

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Abstract: This talk is concerned with finite element error estimates in the L^2-norm on the boundary for linear elliptic partial differential equations with Neumann boundary condition in convex and non-convex polygonal domains. An investigation of the literature reveals that optimal estimates are only available for domains with a maximum interior angle smaller than $\pi/2$. We prove that a convergence order close to two can also be obtained up to an interior angle of $2\pi/3$ still using quasi-uniform meshes. For domains with larger interior angles we use mesh grading techniques to compensate the influence of corner singularities.

This result is applied to linear-quadratic Neumann boundary control problems with pointwise inequality constraints on the control and nearly second order convergence is proven for the approximations of the continuous solution using the variational discretization concept and the postprocessing approach. Finally, the quality of the approximations is demonstrated by a numerical example.

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