On the finite element approximation of elliptic optimal control problems with Neumann boundary control

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A Neumann boundary control problem for a linear-quadratic elliptic optimal control problem in a convex and polygonal domain is investigated. The main goal is to show an optimal approximation order for discretized problems after a postprocessing process. It turns out that two saturation processes occur: The regularity of the boundary data of the adjoint is limited if the largest angle of the polygon is at least $2\pi/3$. For piecewise linear finite elements, the theory cannot deliver optimal approximation rates for convex domains. We will derive error estimates of order h^σ with $\sigma \in [3/2, 2]$ depending on the lagest angle and properties of the finite elements. Moreover, we will investigate also the case of domains with a reentrant corner. Here, we obtain error estimates of order h^σ with $\sigma \in [1, 3/2]$ Finally, numerical tests illustrates the theoretical results.

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