Kolloquium Angewandte Mathematik
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Vortragsankündigung

Am **Mittwoch, den 22.02.2017,** hält **um 17:00 Uhr**

Piotr Swierczynski
(TUM)

einen Gastvortrag über das Thema

Applications of energy-corrected finite element to optimal control and parabolic problems

Der Vortrag findet im **Raum 1401** in **Gebäude 33** statt.

Vortragszusammenfassung

It is a well-known fact that the presence of re-entrant corners, i.e. corner with angle $\Theta > \pi$, in polygonal domains leads to the loss of regularity of solutions of elliptic problems [1]. This, in turn, means that only a suboptimal order of convergence of their standard piecewise linear finite element approximation can be obtained. Recently, an effective method of recovering the full second-order convergence for elliptic equations on domains with re-entrant corners, when measured in locally modified L_2 and H^1 norms, known as energy-correction, has been proposed [2]. This method is based on a modification of a fixed number of entries in the system's stiffness matrix. In this talk, we present two applications of the energy-correction method.
Firstly, we show how the energy-correction method can be applied to finding an approximation of optimal Dirichlet boundary control problem on non-convex domains. We present the saddle-point structure of the problem and investigate the convergence properties of the method building on the work conducted in [3].
Secondly, we show how the energy-correction method can be applied to regain optimal convergence in weighted norms for parabolic problems and introduce a post-processing strategy yielding optimal convergence order in standard Sobolev norms. Standard discretization approach involving graded meshes results in a very restrictive form of a CFL condition, making the use of explicit time stepping practically impossible. On the other hand, the energy-correction can be used on uniform meshes, allowing for application of explicit time stepping scheme with relatively large time steps. This, combined with mass-lumping strategy, leads to a very efficient discretization of parabolic problems, where at each time step only one vector multiplication with a scaled stiffness matrix needs to be performed. Finally, we extend this idea to higher-order finite element methods.
All theoretical results are confirmed by the numerical tests.

Literatur

[1] V. A. Kondratiev. Boundary value problems for elliptic equations in domains with conical or angular points. *Trans. Moscow Math. Soc.*, 16:227–313, 1967.

[2] H. Egger, U. Rüde, and B. Wohlmuth. Energy-corrected finite element methods for corner singularities. *SIAM J. Numer. Anal.*, 52(1):171–193, 2014.

[3] G. Of, T. X. Phan, and O. Steinbach. An energy space finite element approach for elliptic Dirichlet boundary control problems. *Numer. Math.*, 129(4):723–748, 2015.

Alle Interessierten sind dazu herzlich eingeladen.