Ulrich Ruede

A multi-scale algorithm to recover optimal convergence in the presence of corner singularities

Universitaet Erlangen
Cauerstrasse 11
91080 Erlangen
Germany
ruede@cs.fau.de
Christian Waluga
Barbara Wohlmuth
Herbert Egger

Elliptic problems with reentrant corners exhibit the well-known pollution-effect, i.e. the convergence deteriorates in global norms. This can be avoided by many techniques, such as a suitable mesh grading or by enriching the finite element spaces. Here we analyze a new method that restores optimal converge in weighted norms and that differs form alternatives in requiring only local corrections on uniform or quasi-uniform grids. We show that the corrections must be such that the modified finite element discretization reproduces the energy of the solution with sufficient accuracy. This can be achieved by a suitable modification in a small, fixed number of elements. The corresponding stiffness matrix differs from the uncorrected one in only a few numerical values. The correction parameter for each reentrant corner can be computed efficiently in a multi-scale approach that can be integrated in a full multigrid method.