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A CONVERGENT ADAPTIVE FINITE ELEMENT METHOD WITH OPTIMAL COMPLEXITY*

ROLAND BECKER†, SHIPENG MAO‡, AND ZHONG-CI SHI‡

Abstract. In this paper, we introduce and analyze a simple adaptive finite element method for second order elliptic partial differential equations. The marking strategy depends on whether the data oscillation is sufficiently small compared to the error estimator in the current mesh. If the oscillation is small compared to the error estimator, we mark as many edges such that their contributions to the local estimator are at least a fixed proportion of the global error estimator (bulk criterion for the estimator). Otherwise, we reduce the oscillation by marking sufficiently many elements, such that the oscillations of the marked cells are at least a fixed proportion of the global oscillation (bulk criterion for the oscillation). This marking strategy guarantees a strict reduction of the error augmented by the oscillation term. Both convergence rates and optimal complexity of the adaptive finite element method are established, with an explicit expression of the constants in the estimates.

Key words. adaptive finite element method, a posteriori error estimator, convergence rate, optimal computational complexity

AMS subject classifications. 65N12, 65N15, 65N30, 65N50

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† Laboratoire de Mathématiques Appliquées UMR-CNRS 5142, Université de Pau, 64013 Pau Cedex, France (roland.becker@univ-pau.fr).

‡ Institute of Computational Mathematics and Scientific/Engineering Computing, Academy of Mathematics and System Science, Chinese Academy of Science, PO Box 2719, Beijing, 100080, China ({maosp, shi}@lsec.cc.ac.cn).