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## **1 Unified Multilevel Adaptive Finite**

1 UNIFIED MULTILEVEL ADAPTIVE FINITE ELEMENT METHODS FOR ELLIPTIC PROBLEMS BY WILLIAM F. MITCHELL B.S., Clarkson College of Technology, 1977 M.S., Clarkson College of Technology, 1979 M.S., Purdue University, 1983 THESIS Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Computer Science in the Graduate College of the University of Illinois at Urbana-Champaign, 1988 Urbana, Illinois

## **1 UNIFIED MULTILEVEL ADAPTIVE FINITE ELEMENT**

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## **METHODS FOR ...**

It is our goal to develop a more unified approach to the combined process of adaptive refinement and multigrid solution which can be used with high order finite elements. The basic step of the refinement process is the bisection of a pair of triangles, which corresponds to the addition of one or more basis functions to the approximation space.

## **IDEALS @ Illinois: Unified Multilevel Adaptive Finite ...**

You can learn more about the methods used in MGGHAT by reading ``Unified multilevel adaptive finite element methods for elliptic problems'' (pdf, 260K). The MGGHAT software is available as a single gzipped tar file (300K), or as three parts (source, documentation and graphics examples) from netlib.

## **MGGHAT - NIST**

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<http://citeseerx.ist.psu.edu/v...> (external link) [http ...](http://...)

## **UNIFIED MULTILEVEL ADAPTIVE FINITE ELEMENT METHODS FOR ...**

1. Introduction. The recently proposed multi-level hp-refinement is a novel approach for performing adaptive mesh refinement in the context of high-order finite elements. Contrary to conventional hp-adaptive methods, which perform spatial refinement by the replacement of existing elements with a subset of smaller elements , , , this method employs hierarchical, high-order overlay meshes to ...

## **Parallelization of the multi-level hp-adaptive finite cell ...**

Many elliptic partial differential equations can be solved numerically with near optimal efficiency through the uses of adaptive refinement and multigrid solution techniques. This

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paper presents a more unified approach to the combined process of adaptive refinement and multigrid solution which can be used with high order finite elements.

### **Optimal Multilevel Iterative Methods for Adaptive Grids**

...

Brandt, A. (1973), Multi-level adaptive technique (MLAT) for fast numerical solution to boundary value problems. Proc. Third International Conference on Numerical Methods in Fluid Mechanics, Vol. 18 of Lecture Notes in Physics, Springer, pp. 82 - 89.

### **Algebraic multigrid methods \* | Acta Numerica | Cambridge Core**

For example, one use of wavelets is to reformulate the finite element approach in terms of a multilevel method. [17] Adaptive multigrid exhibits adaptive mesh refinement , that is, it adjusts

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the grid as the computation proceeds, in a manner dependent upon the computation itself. [18]

### **Multigrid method - Wikipedia**

One aspect of adaptive mesh refinement in the finite element method for solving partial differential equations is the method by which elements are refined. In the early 1980's the dominant method for refining triangles was the red-green algorithm of Bank and Sherman. The red refinements are the desired refinements, but will result in an incompatible grid when used alone.

### **30 years of newest vertex bisection: AIP Conference ...**

OSTI.GOV Technical Report: Unified multilevel adaptive finite element methods for elliptic problems Title: Unified multilevel adaptive finite element methods for elliptic problems Full Record

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### **Unified multilevel adaptive finite element methods for ...**

In this paper, we present a unified analysis of both convergence and optimality of adaptive mixed finite element methods for a class of problems when the finite element spaces and corresponding a p...

### **A Unified Analysis of Quasi-Optimal Convergence for ...**

The PHAML project is to develop new methods and software for the efficient solution of 2D elliptic partial differential nist-equations (PDEs) on distributed memory parallel computers and multicore computers using adaptive mesh refinement and multigrid solution techniques. PHAML version 1.20.0 can be downloaded as the file phaml-1.20.0.tar.gz(10.8 MB) for Unix systems and MS Windows with Cygwin.

### **The Parallel Hierarchical Adaptive MultiLevel Project ...**

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## **Multi-level adaptive finite element analysis. - Page 1 - CORE**

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Results for the three-level and single-level approach are summarised in Fig. 4. For adaptive spatial meshes, we observe that the errors of the expected values  $E[\psi^2(\text{ML})]$  are very close to the prescribed tolerances. This is not always the case for the values  $E[\psi^2(\text{SL})]$  computed by the single-level approach. The three-level approach performs reliably and outperforms the single-level version ...

### **A fully adaptive multilevel stochastic collocation ...**

For certain pairs, we also prove new theoretical estimates for the associated CBS constants using only linear algebra arguments. Second, we design a novel adaptive multilevel SGFEM algorithm, where each solution mode is associated with a potentially different finite element space.

### **Adaptive & Multilevel Stochastic Galerkin Finite Element**

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In this project, we carried out many studies on adaptive and parallel multilevel methods for numerical modeling for various applications, including Magnetohydrodynamics (MHD) and complex fluids. We have made significant efforts and advances in adaptive multilevel methods of the multiphysics problems: multigrid methods, adaptive finite element ...

### **Scalable Adaptive Multilevel Solvers for Multiphysics ...**

Mitchell W.F., Unified multilevel adaptive finite element methods for elliptic problems, internal report no. UIUCDCS-R-88-1436, Department of computer science, University of Illinois at Urbana-Champaign, Urbana, Illinois(1988) Google Scholar

### **On the sparsity patterns of hierarchical finite element ...**

Mitchell, W.F.: Unified Multilevel Adaptive Finite Element Methods for Elliptic Problems. Report No. UIUCDCS-R-88-1436, Department of Computer Science, University of Illinois (1988).

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Google Scholar [10] Ong, M. E. G.: Hierarchical Basis Preconditioners for Second Order Elliptic Problems in Three Dimensions. Technical Report No. 89-3, Department ...

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