Department of Mathematical Sciences Colloquium

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On Automatic Adaptivity for Finite Element Methods

Automatic adaptivity, i.e., automatic computer-driven adjustment of finite element meshes aimed at improving the numerical resolution, is an indivisible part of Finite Element Methods (FEM). While efficient adaptive strategies have been designed for standard (lowest-order) FEM in the last decades, much less has been done in the context of *hp*-FEM. The *hp*-FEM is a modern version of the finite element method which combines variable size elements with nonuniform distribution of the polynomial degree in the mesh in order to achieve *exponential convergence*. In particular, for problems whose solutions exhibit multiple spatial scales, *hp*-FEM typically delivers more accurate approximation than standard numerical methods for partial differential equations including standard FEM, using a small fraction of their CPU time.

In this talk we give an introduction to *hp*-FEM for broader audience, and discuss in more detail our new results related to automatic adaptivity. We developed a unifying approach which works both for standard FEM and *hp*-FEM. Performance comparisons between standard FEM and *hp*-FEM are presented. The positive role of constrained approximation (approximation with "hanging nodes") in automatic adaptivity is discussed and illustrated numerically. At the end we present performance comparisons which show superiority of our results over recently published results of other renowned researchers in this field.

Friday, March 24, 2006 at 3 pm in Bell Hall 143
The University of Texas at El Paso

Refreshments will be served in front of the colloquium room, 15 minutes before the start of the colloquium.

For further information, please contact Dr. Pavel Šolín, Bell Hall 220. Phone: (915) 747-6770, email: `solin@utep.edu`.