Numerical Analysis and Scientific Computing Seminar

Improving PDE approximation via anisotropic mesh adaptation

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Abstract: Anisotropic meshes have proved to be a powerful tool for improving the quality and the efficiency of numerical simulations in scientific computing, especially when dealing with phenomena characterized by directional features such as, for instance, sharp fronts in aerospace applications or steep boundary or internal layers in viscous flows around bodies. In these contexts, standard isotropic meshes often turn out to be inadequate since they allow one to tune only the size of the mesh elements while completely missing the directional features of the phenomenon at hand. On the contrary, via an anisotropic mesh adaptation it is possible to control the size as well as the orientation and the shape of the mesh elements. In this presentation we focus on an anisotropic setting based on the concept of metric. In particular, to generate the adapted mesh, we derive a proper metric stemming from an error estimator. This procedure leads to optimal grids which minimize the number of elements for an assigned accuracy. After introducing the theoretical context, several test cases will be provided to emphasize the numerical benefits led by an anisotropic approach. An overview of the ongoing research will complete the presentation.

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