数学与系统科学研究院

计算数学所学术报告

(定期学术报告)

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报告题目：　A Posteriori Error Estimation and Its Applications

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计算数学所报告厅

Abstract:

Despite significant progress made in the

Computational Fluid Dynamics (CFD) study over past decades, challenges remain in efficiently achieving a high-quality numerical solution of large-scale fluid mechanics problems with geometries of practical interests. In order to resolve the conflict between mesh size and solution accuracy, adaptive grid generation methods become more and more attractive to the CFD researchers. One of the main issues arising in connection with adaptive algorithms is how to determine where adaptive re-meshing is needed.

In addressing this issue, a mathematical criterion based on *a posteriori* error estimates has been studied - the errors within each element on a mesh are estimated by solving a local Neumann problem corresponding to the mathematical model of interests; then, the *a posteriori* error estimates are used to form both local and global energy norms involving all the physical variables in the model chosen; this energy norm serves as error index to be reduced

through local mesh refinements and, ultimately, to be approximately equi-distributed over the mesh through simultaneous mesh refinement and coarsening, along with node moving.
A variety of numerical experiments covering the potential flow, Stokes flow, and Navier-Stokes flow models have been performed using finite element mesh adaptive algorithms oriented by *a posteriori* error estimates. Through this series of test cases, the generality and reliability of the *a posteriori* error estimation approach have been demonstrated for guiding mesh adapted towards a more accurate numerical solution to environmental engineering and aerospace engineering problems without requiring a significant increase of computational cost.

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