数学与系统科学研究院

计算数学所学术报告

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报告题目：

Adaptive and multiscale computation for porous media phenomena

邀请人： 明平兵副研究员

报告时间： **2007 年 7 月 27 日(周五)**

下午 16:00—17:00

报告地点： **科技综合楼三层 311**

计算数学所报告厅

Abstract：

Flow and transport in porous media has important

applications for petroleum reservoir engineering and groundwater processes. Both applications may involve multiple time and spatial scales, long simulation time periods, and many coupled nonlinear components. In particular, the advection-dominated component, the nonlinear reaction, heterogeneous permeabilities and their nonlinear coupling often result in sharp concentration fronts, demanding steep gradients to be preserved with minimal oscillation and numerical diffusion. To address these issues, we propose to solve the system by DG method, a specialized finite element method that utilizes discontinuous spaces to approximate solutions. Among other advantages, DG method possesses local mass conservation, small numerical diffusion and little oscillation as well as its abilities to capture the discontinuities and sharp fronts in the solution. In this talk, DG with dynamic mesh adaptation for simulating flow and transport in porous media will be presented, where we utilize estimates called error indicators to assess the quality of the results and modify the mesh or other discretization parameters during the solution process

aiming to achieve approximate solution within some error

tolerance while reducing computational cost. Various properties of errors indicators will be discussed and compared; in particular, we will address their efficiency (in terms of computing error indicators alone) and effectivity (in terms of guiding good distribution of discretization parameters). In addition, we will discuss multiscale implementation of DG, where we first construct local basis functions at the coarse scale that capture the local properties of the differential operator at the fine scale, and then solve the DG formulation using the newly constructed local basis functions instead of conventional polynomial functions on the coarse scale elements. Numerical examples will be provided to show the effectiveness of dynamic mesh adaptation and multiscale implementation. If time allows, preliminary results on multiscale modeling and computation of turbulence flow and mass transport in porous media will also be presented.

欢迎大家参加！