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：

Fast and faith numerical methods and mathematical analysis of space-fractional diffusion equations

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报告时间：**2014** 年 **6** 月 **17** 日（周二）

下午 **16:00-17:30**

报告地点：　科技综合楼三层 **301**

计算数学所小报告厅

Abstract:

Fractional diffusion equations provide an adequate and accurate description of transport processes that exhibit anomalous diffusion that is characterized by an inverse power law detail decaying behavior of the corresponding probability density function. These processes range from the signaling of biological cells, anomalous electrodiffusion in nerve cells, foraging behavior of animals, and electrochemistry among other applications. However, fractional differential equations raise mathematical and numerical difficulties that have not been encountered in the context of second-order differential equations.

Computationally, because of the nonlocal property of fractional differential operators, the numerical methods for fractional diffusion equations often generate dense coefficient matrices. consequently, these methods often require computational work of $O(N^3)$ to invert per time step and memory of $O(N^2)$ for where N is the number of unknowns. Mathematically, fractional differential equations exhibit mathematical properties that have fundamental differences from those of second-order differential equations.

In this talk we go over the development of faithful and efficient numerical methods for space-fractional partial differential equations, without resorting to any lossy compression, but rather by exploring the structure of the coefficient matrices. These methods have computational cost of $O(N \log^2 N)$ per time step and memory of O(N), while retaining the same accuracy and approximation property of the underlying numerical methods.

We will also address mathematical issues on the space-fractional differential equations such as wellposedness and regularity of the problems and their impact on the convergence behavior of numerical methods. We will report our recent progress in this direction.

欢迎大家参加！