数学与系统科学研究院

计算数学所学术报告

报告人： **Prof. Hong Wang**

（ Shandong University and University of South Carolina ）

报告题目：

Fast and accurate numerical methods for space-fractional PDEs

邀请人： 唐贻发 研究员

报告时间：2015 年 5 月 26 日（周二）

上午 10:00

报告地点： 科技综合楼三层

311 报告厅

Abstract：

Fractional PDEs provide an adequate and accurate description of transport processes that exhibit anomalous diffusion that is characterized by an algebraically decaying behavior of the corresponding probability density functions.

Computationally, because of the nonlocal property of fractional differential operators, the numerical methods for FPDEs often generate dense stiffness matrices. Traditionally, direct methods were used to solve these problems, which require $O(N^3)$ computations (per time step) and $O(N^2)$ mememy, where N is the number of unknowns.

We go over the development of accurate and efficient numerical methods for space-fractional PDEs, which has an optimal order storage and almost linear computational complexity. These methods were developed by utilizing the structure of the stiffness matrices. No lossy compression or approximation was used. Hence, these methods retaining the same accuracy and approximation/conservation property of the underlying numerical methods.

We will also discuss the open problems in the development and our future direction of research.

欢迎大家参加！

BIOGRAPHICAL SKETCH OF HONG WANG

Professor of Mathematics, Department of Mathematics and Interdisciplinary Mathematics Institute, University of South Carolina, Columbia, SC 29208, USA; 803-777-4321 (O), hwang@math.sc.edu

Professional Preparation

Ph.D. Mathematics, University of Wyoming, 1992, Supervisor: R.E. Ewing; Postdoc, Texas A&M University, 1992-1993; B.S. & M.S. Computational Mathematics, Shandong University, 1982 & 1984.

Selected Appointments

1993–1998, 1998–2003 and 2003–present, Assistant Professor, Associate Professor and Professor of Mathematics, University of South Carolina; 2005–2010, Shandong University Lecturing Professor; 2010–present, Shandong Province Taishan Overseas Professor; 2012–present, Changjiang Lecturing Professor.

Member, Editorial Boards:

- Numerical Methods for Partial Differential Equations, 2000-present
- Journal of Korean SIAM, 2001–present
- Computing and Visualization in Science,2004–present
- International Journal of Numerical Analysis & Modeling, 2007–present
- The Modeling and Computation for Flow and Transport, 2010–present.

Refereed Research Publications in the Past Five Years:

Number of refereed SCI publications in the past five years (=24) and 6 representative publications:

- H. Wang and T.S. Basu, A fast finite difference method for two-dimensional space-fractional diffusion equations, *SIAM J. Sci. Comput.*, 34 (2012), A2444-A2458.
- H. Wang, W. Zhao, M.S. Espedal, and A.S. Telyakovskiy, A component-based Eulerian-Lagrangian formulation for multicomponent multiphase compositional flow and transport in porous media, *SIAM J. Sci. Comput.*, 35 (2013), B462-B486.
- H. Wang and D. Yang, Wellposedness of variable-coefficient conservative fractional elliptic differential equations, *SIAM J. Numer. Anal.*, 51 (2013), 1088-1107.
- H. Wang and H. Tian, A fast and faithful collocation method with efficient matrix assembly for a two dimensional nonlocal diffusion model, *Comput. Methods Appl. Mech. Engrg.*, 273C (2014), 19-36.
- H. Wang and X. Zhang, A high-accuracy preserving spectral Galerkin method for the Dirichlet boundary-value problem of variable-coefficient conservative fractional diffusion equations, *J. Comput. Phy.*, 281 (2015), 67-81.
- H. Wang, Y. Ren, J. Jia, and M.A. Celia, A probabilistic collocation Eulerian-Lagrangian localized adjoint method on sparse grids for assessing CO_2 leakage through wells in randomly heterogeneous porous media, *Comput. Methods Appl. Mech. Engrg.* 10.1016/j.cma.2014.11.034.