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：

速度离散 Boltzmann-BGK 方程的高可扩展隐式方法

报告时间：**2014** 年 **2** 月 **10** 日（周一）

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计算数学所报告厅

Abstract:

Existing approaches for solving the discrete-velocity Boltzmann-BGK equations are explicit and semi-implicit, both have certain stability constraints on the time step size. In this talk, a fully implicit finite difference scheme is developed. For time dependent discrete-velocity Boltzmann-BGK equations, we focus on a parallel, highly scalable, Newton-Krylov-RAS algorithm for the solution of a large sparse nonlinear system of equations arising at each time step. Here, RAS is a restricted additive Schwarz preconditioner based on a first-order spatial discretization. We show numerically that by using the fully implicit method the time step size is no longer constrained by the CFL condition, and the Newton-Krylov-RAS algorithm is scalable on a supercomputer with more than ten thousands processors. Moreover, to calculate the steady state solution we investigate an adaptive time stepping strategy. The total compute time required by the implicit method is much smaller than that of an explicit method for several test cases. For time independent discrete-velocity Boltzmann-BGK equations, a fully implicit scheme is discussed, together with a nonlinearly preconditioned algorithm for the solution of the large sparse nonlinear system of equations. We show by numerical experiments that the new method is robust for high Reynolds number flows and is scalable on a supercomputer with thousands of processors.

This is a joint work with Prof. Xiao-Chuan Cai and Chao Yang.

欢迎大家参加！