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：

Numerical methods for porous medium equation by energetic variational approach

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714 教室

Abstract:

We study numerical methods for porous media equation. There are two important characteristics: the finite propagation of the free boundary and the potential waiting time, which make the problem not easy to handle. Based on different dissipative energy laws, we develop two numerical schemes by an energetic variational approach, which keeps the balance of the least action principle and the maximum dissipation principle.

Firstly, based on $f \log f$ form of the total energy, we obtain the trajectory equation, and then construct a fully discrete scheme. We prove that the numerical scheme of the trajectory equation is uniquely solvable on a convex set and keeps the discrete energy dissipation law. Nextly, based on $1/f$ form of total energy, we construct a linear numerical scheme for the corresponding trajectory equation, which also keeps the discrete dissipation law. Meanwhile, under some smoothness assumption, it is proved, by a higher order expansion technique, that both schemes are second-order convergence in space and first-order convergence in time.

Each scheme yields a good approximation for the solution and the free boundary. No oscillation is observed for the numerical solution around the free boundary. Furthermore, the waiting time problem could be treated naturally, which is hard for all the existence methods. As a linear scheme, the second scheme is more efficient.

This is joint work with Chenghua Duan, Chun Liu and Cheng Wang

欢迎大家参加！