

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 Nonlinear Preconditioning
Techniques**

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报告时间: 2019 年 4 月 27 日 (周六)

上午 9:00-11:00

报告地点: 数学院南楼二层

212 教室

Abstract:

Nonlinear preconditioning is a globalization technique for Newton's method applied to systems of equations with unbalanced nonlinearities, in which nonlinear residual norm reduction stagnates due to slowly evolving subsets of the degrees of freedom. Even though the Newton corrections may effectively be sparse, a standard Newton method still requires large ill- conditioned linear systems resulting from global linearizations of the nonlinear residual to be solved at each step. Nonlinear preconditioners may enable faster global convergence by shifting work to where it is most strategic, on subsets of the original system. They require additional computation per outer iteration while aiming for many fewer outer iterations and correspondingly fewer global synchronizations. In this work, we improve upon previous nonlinear preconditioning implementations by introducing parameters that allow turning off nonlinear preconditioning during outer Newton iterations where it is not needed. Numerical experiments show that the adaptive nonlinear preconditioning algorithm has performance similar to monolithically applied nonlinear preconditioning, preserving robustness for some challenging problems representative of several PDE-based applications while saving work on nonlinear subproblems.

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