Nonlinear Preconditioning for PDEs

<u>Xiao-Chuan Cai</u>[1]

Abstract

We consider solving system of nonlinear algebraic equations arising from the discretization of partial differential equations. When the nonlinearities in the system is well-balanced, Newton method works well, but when a small number of nonlinear functions in the system are much more nonlinear than the others, Newton may converge slowly or stagnate. In such a situation, we introduce some nonlinear preconditioners to balance the nonlinearities in the system. For the nonlinearly preconditioned problem, we show that fast convergence can be restored. One of the difficulties in nonlinear preconditioning is that it is often difficult to find the region in which the nonlinearity is high. In this talk we discuss some recent progress in the application of unsupervised learning for some difficulty problems in computational fluid dynamics.

[1]University of Colorado Boulder