Efficient solutions to PDEs on complex domains: Fourier Continuation - alternating direction methods

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Thursday, October 28, 2010
007 Kemeny Hall, 4:00 pm
(Tea 3:30 pm 300 Kemeny Hall)

Abstract

A new methodology for the numerical solution of Partial Differential Equations (PDEs) in smoothly bounded domains will be presented. Our algorithms are based on the use of a certain "Fourier Continuation" (FC) method for the resolution of the Gibbs phenomenon in conjunction with well-known alternating direction (AD) strategies. This FC-AD methodology will be demonstrated through a variety of examples including the Heat, Laplace, Wave Equations and both Dirichlet and Neumann problems. The high-order algorithms possess the desirable property of unconditional stability for general domains in computational time that grows in an essentially linear manner with the number of unknowns. The significant improvements that these new algorithms can provide over the computing times and memory required by alternative general-domain solvers will be discussed. In particular, the debilitating spatial "pollution error", which arises as finite-difference and finite-element solvers are applied to the solution of wave propagation problems, is essentially absent from our calculations due to the Fourier basis used in the FC-AD calculations.

This talk should be accessible to graduate students. 1285531373