THE UNIVERSITY OF CHICAGO | THE COMMITTEE ON COMPUTATIONAL AND APPLIED MATHEMATICS

COLLOQUIUM

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Lightweight, geometrically flexible fast algorithms for the evaluation of elliptic and parabolic layer potentials

THURSDAY, May 14th at 4:00 PM
Jones 303, 5747 S. Ellis Ave. Chicago, IL 60637

ABSTRACT

Over the last several decades, fast, robust, and high-order accurate methods have been developed for solving elliptic and parabolic partial differential equations in complicated geometry using potential theory. In this approach, rather than discretizing the partial differential equation itself, one first evaluates a volume integral to account for a source distribution within the domain (if any), followed by solving a boundary integral equation to impose the specified boundary conditions.

We present a new set of fast algorithms which are easy to implement and compatible with virtually any discretization technique, including unstructured domain triangulations, such as those used in standard finite element or finite volume methods. Our approach combines earlier work on potential theory for the heat equation, asymptotic analysis, the nonuniform fast Fourier transform (NUFFT), and the dual-space multilevel kernel-splitting (DMK) framework. It is insensitive to flaws in the triangulation, permitting not just nonconforming elements, but arbitrary aspect ratio triangles, gaps and various other degeneracies.

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