THE UNIVERSITY OF CHICAGO

Departments of Computer Science, Mathematics, Statistics, and the Computation Institute

SCIENTIFIC AND STATISTICAL COMPUTING SEMINAR

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The Abstract Hodge-Dirac Operator and Its Stable Discretization

THURSDAY, October 17, 2013 at 4:30 PM

Eckhart 133, 5734 S. University Avenue

ABSTRACT

In the numerical analysis of elliptic PDEs, much attention has been given (quite rightly) to the discretization of the Laplace operator and other second-order Laplace-type operators, e.g., the Hodge-Laplace operator on differential k-forms. By comparison, Dirac-type operators have received little attention from the perspective of numerical PDEs—despite being, in many ways, just as fundamental. Informally, a Dirac-type operator is a square root of some Laplace-type operator, and is therefore a first-order (rather than second-order) differential operator. The study of these operators is central to the field of Clifford analysis, where there has been growing interest in the discretization of Dirac-type operators. This talk introduces the abstract Hodge-Dirac operator, which is a square root of the abstract Hodge-Laplace operator arising in finite element exterior calculus. We prove stability and convergence estimates, and show that many of the results in finite element exterior calculus can be recovered as corollaries of these new estimates.

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