1016-65-1 **Douglas N Arnold***, Institute for Mathematics and its Application, 400 Lind Hall, 207 Church St. SE, University of Minnesota, Minneapolis, MN 55442. *Finite element exterior calculus and its applications.*

Finite element exterior calculus is a new theoretical approach to the design and understanding of discretizations for a wide variety of systems of partial differential equations. This approach brings to bear tools from differential geometry, algebraic topology, and homological algebra to develop discretizations which are compatible with the geometric, topological, and algebraic structures which underlie well-posedness of the PDE problem being solved. In the finite element exterior calculus, many finite element spaces are revealed as spaces of piecewise polynomial differential forms. These spaces connect to each other in discrete subcomplexes of elliptic differential complexes, which are themselves connected to the continuous elliptic complex through projections which commute with the complex's differential. This structure relates directly to the stability of discretization methods based on the finite element spaces. Applications include elliptic systems, electromagnetism, elasticity, elliptic eigenvalue problems, and preconditioners. (Received January 16, 2006)