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Douglas N Arnold and **Richard S Falk*** (falk@math.rutgers.edu), Department of Mathematics, Rutgers University, Piscataway, NJ 08854, and **Ragnar Winther**. *Bounded Cochain Projections and Approximation of the Hodge Laplacian*.

We study the numerical discretization by mixed finite element methods of boundary value problems associated to the de Rham complex, and more specifically to the Hodge Laplacian. In concrete terms, this allows us to simultaneously study the approximation of a number of important partial differential equations that can be stated in terms of the operators grad, curl, and div. These include Poisson's equation, the vector Laplacian, Maxwell's equations, and div-curl systems. We show that a stable discretization is achieved if (i) the finite element spaces can be arranged as a subcomplex of the de Rham complex and (ii) there exists a bounded cochain projection from the de Rham complex to the subcomplex. The theory can be extended to other applications in which the de Rham complex is replaced by a more general complex of Hilbert spaces. (Received January 20, 2010)