1057-65-226 **Peter Monk*** (monk@math.udel.edu), Department of Mathematical Sciences, University of Delaware, Newark, DE 19350, and **Richard Falk**. *Hexahedral H(div) and H(curl) Finite Elements.*

We study the approximation properties of some finite element subspaces of $H(div)$ and $H(curl)$ defined on hexahedral meshes in three dimensions. These finite elements are relevant to numerical methods for porous media flow and Maxwell's equations respectively. The finite element spaces we consider are constructed starting from a given finite dimensional space of vector fields on the reference cube, which is then transformed to a space of vector fields on a hexahedron using the appropriate transform (e.g., the Piola transform) associated to a trilinear isomorphism of the cube onto the hexahedron. After determining what vector fields are needed on the reference element to insure $O(h)$ approximation in $L^2(\Omega)$ and in $H(div)$ and $H(curl)$ on the physical element, we study the properties of the resulting finite element spaces. In particular we show that standard spaces may not give a convergent scheme. We then give an extension of the standard spaces that does guarantee convergence on a regular mapped hexahedral grid. (Received January 23, 2010)