

MIMETIC SCHEMES ON NON-UNIFORM STRUCTURED MESHES*

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Dedicated to Víctor Pereyra on the occasion of his 70th birthday

Abstract. Mimetic operators are approximations that satisfy discrete versions of continuum conservation laws. We propose a technique for constructing mimetic divergence and gradient operators over non-uniform structured meshes based on the application of local transformations and the use of a reference set of cells (RSC). The RSC is not a mesh, but a set of two uniform elements that are used while the operators are being built. The method has been applied to construct second and fourth order gradient and divergence operators over non-uniform 1D meshes. Our approach leaves invariant the boundary operator expressions for uniform and non-uniform meshes, which is a new result and an advantage of our formulation. Finally, a numerical convergence analysis is presented by solving a boundary layer like problem with Robin boundary conditions; this shows that we can obtain the highest order of accuracy when implementing adapted meshes.

Key words. mimetic schemes, summation-by-part operators, non-uniform meshes, partial differential equations, high order, divergence operator, gradient operator, boundary operator.

AMS subject classifications. 65D25, 65M06, 65G99.

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