RESIDUAL CORRECTION METHOD BASED ON FINITE CALCULUS

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In this work we describe a residual correction method based upon an extension of the finite calculus concept. The method is described and applied to the solution of a scalar convection-diffusion problem and the problem of elasticity (or Stokes flow).

Treatment for incompressibility or near incompressibility in the elasticity (Stokes) problem is discussed. A residual correction formulation permits the use of equal order interpolation for displacements (velocity) and pressure on linear triangles and tetrahedra, as well as, any other low order element type. To add additional stability in the solution, pressure gradient corrections are introduced as suggested from developments of sub-scale methods. Using the additional pressure gradient corrections leads to a formulation which, in two dimensions, has five degrees of freedom at each node – two displacements (velocities), one pressure, and two gradient parameters. Alternative methods for solving the resulting set of equations are discussed and it is shown that a split scheme leads to very little additional effort over that required to solve the displacement-pressure form.

Numerical examples are included to demonstrate the performance of the method when applied to typical test problems.