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A STABILIZED MIXED FINITE ELEMENT METHOD FOR THE FIRST-ORDER FORM OF ADVECTION-DIFFUSION EQUATION

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ABSTRACT

This paper presents a stabilized mixed continuous Galerkin method for the first-order form of the advection-diffusion equation. The new method finds its roots in the notion of an additive split of the velocity field into coarse- and fine-scale components that systematically lead to coarse and fine-scale variational formulations [1-3]. Solution of the fine-scale problem is mathematically embedded in the coarse-scale formulation and this yields the resulting method. A key feature of the method is that the structure of the stability parameter emerges via the solution of the fine-scale problem, and it is free of the characteristic length scale of the mesh. The new method yields a family of equal and unequal order elements that show optimal convergence rates on structured and unstructured meshes. Some benchmark problems with high Peclet number flows and with internal layers are also presented [2].

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