Convergence to weak solutions for the Navier-Stokes equations of a stabilized finite element approximation with dynamic subscales

SANTIAGO BADIA
Centre Internacional de Mètodes Numèrics en Enginyeria (CIMNE)
sbadia@cimne.upc.edu

JUAN VICENTE GUTIÉRREZ SANTACREU
Dpto. de Matemática Aplicada I, Universidad de Sevilla
juanvi@us.es

Resumen

Even though residual-based stabilized finite element formulations of the (Navier-Stokes) equations are typically used in the applied finite element community, their numerical analysis has been restricted to stability estimates and a priori error estimates for smooth solutions (see [4]).

These methods are based on the decomposition of the fluid velocity into a resolvable finite element component plus a modeled sub-grid scale component. We have analyzed two different sub-grid models. On one hand, we consider the classical variational multiscale model proposed by Hughes in [5]. Then, we consider the modification proposed in [2], forcing the sub-grid component to be $L^2$-orthogonal to the finite element space. Furthermore, in both cases we consider a dynamic model for the sub-grid scale (see [3]).

The compactness results in [6, 1] allow us to prove that one can recover a weak solution of the Navier-Stokes in the sense of Leray and Hopf under minimal requirements on the initial condition, forcing terms, and domain. Finally, we investigate if such a solution satisfies an energy estimate.

Sección en el CEDYA 2011: AN

Bibliography


