Coupled analysis of Navier-Stokes and Darcy flows with Coherent Smagorinsky Model

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ABSTRACT

Coupled analysis of Large eddy simulation (LES) in the domain occupied purely by a fluid and the seepage flows in porous media is presented in this paper. The Darcy-Brinkman equations (e.g., Bars and Worster, 2006) were employed as the governing equations in the porous media and the continuous modelling of the flow velocity, which satisfies the Beavers-Joseph condition (Beavers and Joseph, 1967) at the interface between the fluid domain and the porous media, was implemented. Applying the finite volume method to the spatial discretization and the fractional step method to the numerical simulation of the incompressible fluid, the coupling of the turbulent flows in the fluid domain and the seepage flows in porous media has been realized with the coherent Smagorinsky model (CSM; Kobayashi, 2005). Numerical analysis of the lid-driven cavity flow over a porous medium is presented herein and the results show that the proposed numerical method fulfils the stable computation and physically realistic numerical solutions.

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