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A Variational Multiscale Method for the Non-isothermal Incompressible Navier-Stokes Problem

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ABSTRACT

In this paper, a variational multiscale method based on local projection and grad-div stabilization for the numerical simulation of incompressible Navier-Stokes problem is considered. Here we extend a previous result for the isothermal case [1] to non-isothermal flows. An a priori error estimate is given for a case with rather general nonlinear (piecewise constant) coefficients of the subgrid models for the unresolved scales of velocity, pressure, and temperature. Then the design of the subgrid scale models is specified and studied for the benchmark problems of nonisothermal flow in a closed two- and three-dimensional cavity [2] up to high Rayleigh numbers.

References

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[2] Wakashima, S., Saitoh, T.S., Benchmark solutions for natural convection in a cubic cavity using the high-order time-space method. *Int. J. Heat Mass Transfer* **volume** (47), 853-864, (2004).

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