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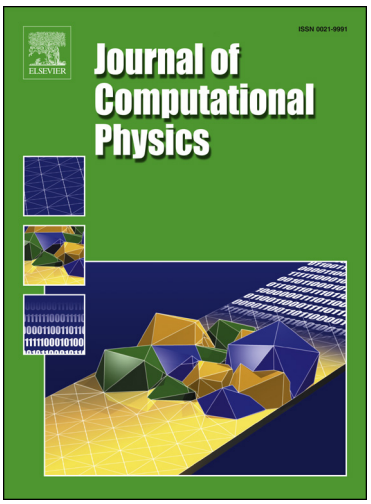

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A Least-Squares/Fictitious Domain Method for Incompressible Viscous Flow around Obstacles with Navier Slip Boundary Condition

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Abstract. In this article, we discuss a least–squares/fictitious domain method for incompressible viscous flow around obstacles with Navier slip boundary condition. Assuming that Ω and B are two bounded sub-domains of $\mathbb{R}^d$, with $\overline{B} \subset \Omega$, in order to solve the incompressible Navier-Stokes equations with a Navier slip condition on the boundary γ of the obstacle B, we advocate a fictitious domain method where one solves a simpler variant of the original problem on the whole Ω, followed by a well-chosen correction over B. This method is of the virtual control type and relies on a least-squares formulation making the problem solvable by a conjugate gradient algorithm operating in a well chosen control space. A detailed discussion of the finite element implementation of the above methodology is also provided. Numerical results are given; they suggest optimal order of convergence.

1 Introduction

Fictitious domain methods for the solution of partial differential equations are very useful methods for the solution of complicated problems. To the best of our knowledge, these methods have been introduced by Hyman [1] and further investigated by many authors; let us mention, among others, Saul'ev [2, 3] and Buzbee, Dorr,

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