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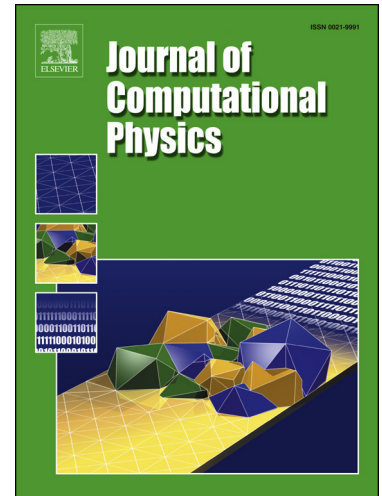
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# A Least-Squares/Fictitious Domain Method for Incompressible Viscous Flow around Obstacles with Navier Slip Boundary Condition

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**AMS subject classifications.** 93E24; 65N85; 76D05; 35Q30

**Keyword.** least-squares, fictitious domain method, incompressible viscous flow, Navier slip boundary condition

**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  $\Omega$  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  $\gamma$  of the obstacle  $B$ , we advocate a fictitious domain method where one solves a simpler variant of the original problem on the whole  $\Omega$ , 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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