

**STRONG SOLUTIONS IN  $L^2$  FRAMEWORK  
FOR FLUID-RIGID BODY INTERACTION PROBLEM.  
MIXED CASE**

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*Dedicated to the memory of Professor Marek Burnat*

**ABSTRACT.** The paper deals with the problem describing the motion of a rigid body inside a viscous incompressible fluid when the mixed boundary conditions are considered. At the fluid–rigid body interface the slip Navier boundary condition is prescribed, having the continuity of velocity just in the normal component, and the Dirichlet condition is given on the boundary of the fluid domain. The existence and uniqueness of the local strong solution is proven by the local transformation and the fixed point argument.

## 1. Introduction

In this paper we investigate the motion of a rigid body inside a viscous incompressible fluid when mixed boundary conditions are considered. The fluid and the body occupy a bounded domain  $\mathcal{O} \subset \mathbb{R}^d$  ( $d = 2$  or  $3$ ).

In order to describe our approach, let us denote by  $\mathcal{B}(t) \subset \mathcal{O}$  a bounded domain occupied by the rigid body and a domain filled by the fluid by  $\mathcal{F}(t) = \mathcal{O} \setminus \overline{\mathcal{B}(t)}$  at a time moment  $t \in \mathbb{R}^+$ . Assuming that the initial position  $\mathcal{B}(0)$  of

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