Application of Navier-Stokes Equation using the Least-Squares Method

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ABSTRACT

We apply the least-squares method to solve two different nonlinear problems which are derived from the Navier-Stokes equation

\[ \rho \left( \frac{\partial \mathbf{u}}{\partial t} + \mathbf{u} \cdot \nabla \mathbf{u} \right) = -\nabla p + \nabla \cdot \mathbf{\tau} + \mathbf{f}. \]  

(1)

Firstly we find an approximation of a solution to the stationary incompressible Newtonian Navier-Stokes equation in 3D. To linearize nonlinear system, we use the Modified Picard method and Newton’s method. We prove the well-posedness of minimization problems with respect to each linearization method.

Moreover, we consider the glaciology problem. Since the ice sheets move slowly, we assume that glaciers are incompressible non-Newtonian fluid. In similar way, we establish the minimization problem and prove the existence of a unique solution. After that, this work presents the numerical computations depending on condition of the viscosity \( \mu \).

REFERENCES