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Problem of second grade fluids in convex polyhedrons. (English) Zbl 1251.35078

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The stationary problem of a grade-two fluid is studied in convex 3D polyhedron Ω. The velocity v and the pressure p satisfy to the equations

$$-\nu\Delta v + \operatorname{curl}(v - \alpha\Delta v) \times v + \nabla p = f,$$
$$\operatorname{div} v = 0 \text{ in } \Omega, v = g \quad \text{on } \partial\Omega,$$

where $\nu > 0$ is the kinematic viscosity coefficient, $\alpha \neq 0$ is the normal stress module, $g \cdot n = 0$. The problem is reformulated in an equivalent form using a transport equation.

The solvability of the problem is proved for small data (f, g). The Galerkin method is the base of the proof. Uniqueness is established for inner angles of a polyhedron smaller than $\frac{3\pi}{4}$.

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MSC:

35Q35 PDEs in connection with fluid mechanics
76A05 Non-Newtonian fluids
35G30 Boundary value problems for nonlinear higher-order PDEs

Keywords:

grade-two fluids; regularity in convex polyhedron; transport equation

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