



Grupo de Física Matemática
da Universidade de Lisboa

SEMINÁRIO DE FÍSICA-MATEMÁTICA (em colaboração com o CMAF/UL)

Dia 17 de Outubro de 2007 (quarta-feira), às 15h30m, na Sala B1-01

“Euler equations with non-homogeneous Navier slip boundary condition”

(joint work with S.N. Antontsev)

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Abstract

We consider the motion of an ideal fluid in a 2D-bounded domain, admitting flows through the boundary of this domain.

The motion of the fluid in a domain $\Omega \subseteq \mathbb{R}^2$ is described by the Euler equations

$$\mathbf{v}_t + \operatorname{div}(\mathbf{v} \otimes \mathbf{v}) - \nabla p = 0, \quad (\mathbf{x}, t) \in \Omega_T := \Omega \times (0, T), \quad (1)$$

$$\operatorname{div} \mathbf{v} = 0, \quad (\mathbf{x}, t) \in \Omega_T \quad (2)$$

with a given initial condition

$$\mathbf{v}(\mathbf{x}, 0) = \mathbf{v}_0(\mathbf{x}), \quad \mathbf{x} \in \Omega \quad (3)$$

and non-homogeneous Navier slip boundary conditions on the boundary of the domain Ω :

$$\mathbf{v} \cdot \mathbf{n} = a, \quad \mathbf{x} \in \Gamma_T := \Gamma \times (0, T), \quad (4)$$

$$2D(\mathbf{v})\mathbf{n} \cdot \mathbf{s} + \alpha \mathbf{v} \cdot \mathbf{s} = b, \quad \mathbf{x} \in \Gamma_T^- := \Gamma^- \times (0, T). \quad (5)$$

Here $\mathbf{v}(\mathbf{x}, t)$ is the velocity of the fluid; $p(\mathbf{x}, t)$ is the pressure; the tensor $D(\mathbf{v})$ is the rate of strain of the velocity \mathbf{v} ; (\mathbf{n}, \mathbf{s}) is the pair formed by the outside normal and tangent vectors to the boundary Γ of Ω ; Γ^- is the part of Γ , where $\mathbf{v} \cdot \mathbf{n} = a < 0$.

The results:

1) We establish the solvability of this problem (1)-(5) realizing the passage to the limit in the Navier-Stokes equations with vanishing viscosity;

2) The solvability is proved in the class of weak solutions with L_p -bounded vorticity, $p \in (2, \infty]$;

3) It is shown that the weak solution satisfies the Navier slip boundary conditions (4)-(5).

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