Fluid Dynamics

ORGANIZERS: Piotr Mucha (*University of Warsaw, PL)*, Agnieszka Świerczew-ska-Gwiazda (*University of Warsaw, PL)*

Monday, July 2, 17:15–19:15, Large Hall B

TALKS:

Piotr Gwiazda (*University of Warsaw, PL*), Flows of fluids described by an implicit constitutive equation characterized by a maximal monotone graph

Reinhard Farwig (*Technische Universitaet, Darmstadt, DE*), On the energy equality of the Navier-Stokes equations

Milan Pokorny (*Charles University, Prague, CZ*), Steady compressible Navier-Stokes-Fourier system with slip boundary conditions

Josef Malek (*Charles University, Prague, CZ*), On large data analysis of Kolmogorovs two equation model of turbulence

Flows of fluids described by an implicit constitutive equation characterized by a maximal monotone graph

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On the energy equality of the Navier-Stokes equations

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We consider a weak instationary solution u of the Navier-Stokes system in a domain $\Omega \subset \mathbb{R}^3$. By a classical result, u satisfies the energy equality (rather than an energy inequality) provided $u \in L^4(0,T,L^4(\Omega))$, see e.g. Shinbrot (1974). Recently, this assumption on u was weakened by Cheskidov, Friedlander, Shvydkoy and Constantin for a bounded domain to the condition $u \in L^3(0,T;W^{5/6,2}(\Omega)) \subset L^3(0,T;L^{9/2}(\Omega))$ and for the whole space case even to $u \in L^3(0,T;B^{1/3}_{3,\infty}(\mathbb{R}^3))$. The question for weakest possible conditions to guarantee the energy equality arises, but seems to be open. In our survey talk we discuss several results in this direction. As a new result we consider general unbounded smooth domains and prove that a weak solution satisfies the energy equality provided that u lies in a space of the type

$$L^3(0,T;W^{1/2,18/7}(\Omega)) \subset L^3(0,T;L^{9/2}(\Omega))$$

using less regularity in space compared to $L^3(0,T;W^{5/6,2}(\Omega))$.

R. Farwig, Y. Taniuchi: *On the energy equality of Navier-Stokes equations in general unbounded domains.* Arch. Math. 95, 447-456 (2010)

Steady compressible Navier-Stokes-Fourier system with slip boundary conditions

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On large data analysis of Kolmogorovs two equation model of turbulence

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Kolmogorov seems to be the first who recognized (in 1941) that a two equation model of turbulence might be appropriate to turbulent ow prediction. We present the results (joint work with M. Bulíček) concerning long-time and large-data existence of weak solution to three-dimensional ows described by this Kolmogorov's two equation model of turbulence. Similar results (joint work with M. Bulíček and R. Lewandowski) associated with one equation model of turbulence (for turbulence kinetic energy) will be presented as well.