

Workshop on

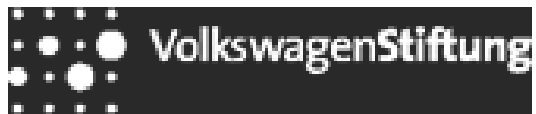
Mathematical Fluid Dynamics

Darmstadt, September 8–10

Abstracts



TECHNISCHE
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HELMUT ABELS

On Two-Phase Flows of Partially Miscible Viscous Fluids

We discuss "diffuse interface models" for the flow of two viscous incompressible Newtonian fluids in a bounded domain. Such models were introduced to describe the flow when singularities in the interface, which separates the fluids, (droplet formation/coalescence) occur. The fluids are assumed to be macroscopically immiscible, but a partial mixing in a small interfacial region is assumed in the model. Moreover, diffusion of both components is taken into account. We discuss recent analytic results concerning well-posedness in the case of fluids with the same and with different densities. In the case of same densities the result are comparable with the results for a single Newtonian viscous fluid described by the Navier-Stokes equation. The case of different densities is significant more difficult since the system is much stronger coupled.

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HUGO BEIRAO DA VEIGA

On the well-posedness theory for evolution equations

In a 1984 paper, published in the Journal of Functional Analysis, T. Kato point out that << continuous dependence in the "strong" topology of the solution on the data is the most difficulty part in a theory dealing with nonlinear equations of evolution >>. At that time, even the existence problem for the Euler compressible equations was open. In the beginning of the 1990s we devoted a sequence of papers to perturbation theory, singular limits and well-posedness problems in the *strong* norm. In particular strong well-posedness of the initial-boundary value problem for the compressible Euler equations was demonstrate for the first time. Our efforts were basically directed to the study of initial-boundary value problems. Clearly, the results may be proved for the corresponding Cauchy problems, in a much simpler way. Our method also allowed singular limit results in the *strong* norm, even under assumptions weaker than the current ones in the literature, where the strong norm is not reached.

In this talk we turn back to our contribution to the above theories, in a necessarily very simplified framework.

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DIETER BOTHE

Sharp-interface models for fluidic particles

We discuss prototype model problems for two-phase flows with fluidic interfaces of different rheological behaviour concerning local-in-time well-posedness and basic stability properties.

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FRANCESCA CRISPO

On the global regularity of stationary shear-thinning flows

We consider a class of generalized stationary Navier-Stokes equations with shear dependent viscosity, under Dirichlet boundary conditions in smooth bounded domains. We are interested in the shear-thinning case, hence we consider a p-system with $p \in (1, 2)$. We show Hölder continuity, up to the boundary, for the gradient of the velocity field together with the summability of the second derivatives, under suitable smallness assumptions on the force term. The results hold for any dimension $n \geq 2$ and without any restriction on the range of p .

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ROBERT DENK

Maximal regularity for mixed-order systems

One possible approach to nonlinear partial differential equations uses maximal L_p -regularity for the linearized problem. By a result of Weis, maximal regularity can be proved by the R-boundedness of the resolvent. In the talk we consider mixed-order systems and their resolvents. In general, a mixed-order system leads to a symbol with inhomogeneous structure, so standard methods of elliptic and parabolic theory cannot be applied. However, the so-called Newton polygon method allows us to analyse the homogeneities hidden in the system and prove resolvent estimates. As applications, one can mention generalized thermoelastic plate equations or the Lopatinskii matrix of free boundary value problems. Maximal regularity and even the existence of a bounded H^∞ -calculus can also be shown for mixed-order systems of pseudodifferential operators.

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LARS DIENING

A decomposition technique for John domains

We develop a method to decompose functions with mean value zero on a (possibly unbounded) John domains into a countable sum of functions with mean value zero and support in cubes or balls. This method enables us to generalize results known for cubes

or balls to the class of John domains and domains satisfying a certain chain condition. As application we present the solvability of the divergence equation $\operatorname{div} u = f$, the negative norm theorem, Korn's inequality, and Poincaré inequality. We present the result for weighted Lebesgue spaces and Orlicz spaces.

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JOACHIM ESCHER

Singularities in shallow water waves

The formation of singularities of classical solutions to several shallow water equations, including the Camassa-Holm and the Degasperis-Procesi (DP) equation is discussed in detail. In particular it is shown that for the DP-equation the first blow-up of a strong solution must occur in the form of a wave breaking and possible shocks may appear only afterwards.

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REINHARD FARWIG

On the existence of local strong solutions for the Navier-Stokes equations in completely general domains

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EDUARD FEIREISL

Mathematical analysis of some non-standard models of compressible fluid flows

We discuss mathematical aspects of a model proposed by Howard Brenner. In particular, the problem of consistency and weak stability are discussed in detail.

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GIOVANNI PAOLO GALDI

The motion of a rigid body in a Navier-Stokes liquid under the action of a time-periodic driving mechanism

We consider the motion of a rigid body in an infinite Navier-Stokes liquid under the action of one of the following driving mechanisms: (i) a time-periodic external force, or (ii) a time-periodic distribution of boundary velocity. In the first part of this talk, we show that, with respect to a frame attached to the body, there exists always a time-periodic weak solution for the coupled system body-liquid, corresponding to data (of mild regularity) and arbitrary magnitude. Moreover, we show that this solution is, in fact, strong, provided the data are suitably restricted in size. In the second part, we furnish sufficient conditions ensuring that the driving mechanism "propels" the body, namely, that the center of mass of the body covers a prescribed distance, L , in a finite time, T . We also give an estimate of T in terms of L .

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THIERRY GALLAY

Stability and interaction of vortices in weakly viscous planar flows

It is known that the two-dimensional incompressible Navier-Stokes equations have a unique global solution if the initial vorticity is a finite measure. We study the inviscid limit of this solution in the particular case where the initial vorticity is a finite sum of Dirac masses. We show that the solution converges to a superposition of stretched Oseen vortices which move in the plane according to a viscous regularization of the Eulerian point vortex system.

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CARLO ROMANO GRISANTI

On the energy equality for the Navier - Stokes problem

We deal with the Navier–Stokes system with homogeneous Dirichlet boundary conditions in a C^2 bounded domain of \mathbb{R}^3 . We look for conditions, which ensure the validity of the following energy equality for a Leray–Hopf weak solution u

$$\|u(t)\|_2^2 + 2\nu \int_s^t \|\nabla u(\tau)\|_2^2 d\tau = \|u(s)\|_2^2 + 2 \int_s^t (f(\tau), u(\tau)) d\tau$$

for every s, t with $0 \leq s < t < T$.

It is well known that the above equation holds true if u belongs to the space $L^r(0, T; L^s(\Omega))$ when $\frac{2}{r} + \frac{3}{s} \leq 1$ with $s \geq 3$ or if $\frac{2}{r} + \frac{2}{s} \leq 1$ with $s \geq 4$. A recent result (A. Cheskidov, S. Friedlander and R. Shvydkoy), in the framework of the space $V^m(\Omega)$, which is the domain of the Stokes operator of power $m/2$, shows that the energy equality also holds for $u \in L^3(0, T; V^{\frac{5}{6}}(\Omega))$. We generalize the result extending the range for the exponent m .

Namely we get that the energy equality holds if $u \in L^p(0, T; V^m(\Omega))$, when there is a suitable relation between the exponents p and m .

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KAROLINE GÖTZE

L^p - strong solutions for the free fall of a rigid body in a fluid

Consider the Navier-Stokes equations coupled with the conservation laws of momentum and angular momentum of a rigid body and apply a gravitational force. We show the existence of a unique strong L^p - solution to the problem.

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YASUSHI HATAYA

Decaying solution of Navier-Stokes flow without surface tension effect

The small smooth solution to the Navier-Stokes flow with free surface is shown to exist with some decay properties in time. The decay properties play an essential role in the proof of the existence of the solution.

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MATTHIAS HE

Stability of Ekman Boundary Layers

We study the stability behaviour of Ekman boundary layers. The Ekman spiral is a special stationary solution of the Navier Stokes equations in a rotating framework which is explicitly given. Using energy methods we prove existence and stability of weak solutions in the case of L^2 perturbations in the halfspace. For L^p perturbations in infinite layers we even prove existence of strong solutions which are exponentially stable.

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TOSHIAKI HISHIDA

Asymptotic profile of the steady Stokes flow around a rotating obstacle

Consider the motion of a viscous incompressible fluid around a rotating obstacle. One may expect that the rotation effect causes a certain anisotropic decay structure of the flow with respect to space variable. In this talk we find such a structure from asymptotic

expansion of the steady Stokes flow. This is a joint work with Reinhard Farwig (TU Darmstadt).

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YOSHIYUKI KAGEI

On the stability of the plane Couette flow of the compressible Navier-Stokes equation

We consider the large time behavior of solutions to the compressible Navier-Stokes equation around the plane Couette flow. We show that if the Reynolds number and the Mach number are sufficiently small, then the plane Couette flow is asymptotically stable for small initial perturbation. Furthermore, the leading part of the perturbation is given by a solution of a heat equation with a convective term.

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SHUICHI KAWASHIMA

Hardy type inequality and application to the stability of degenerate stationary waves

We first introduce a simple Hardy type inequality with the optimal constant. Then we apply it to the stability problem of degenerate stationary waves for viscous conservation laws in one-dimensional half space. We obtain the optimal rate of convergence toward degenerate stationary waves when the initial perturbations are in a weighted space L^2_α with the weight α which is characterized by the degeneracy exponent of the waves.

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T. KOBAYASHI

Fluid Mechanical Approximation to the Degenerated Drift-Diffusion System from Compressible Navier- Stokes-Poisson system

We consider the zero relaxation time approximation to the compressible Navier-Stokes Poisson system to derive the mono-polar drift-diffusion system of degenerated type. To construct the approximation solution, we introduce a regularized damped viscous compressible Navier-Stokes equation and as the relaxation time goes to zero, the weak solution converges that of the degenerated elliptic parabolic system. The entropy functional is rigorously derived from the energy inequality of the approximation system. Self-similar scaled

system is also considered and the analogous weak convergence as well as the rigorous treatment to derive the entropy functional is discussed. The results in this talk were obtained in a joint work with Takayoshi Ogawa (Tohoku Univ.).

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TEPPEI KOBAYASHI

The relation between stationary and periodic solutions of the Navier- Stokes equations in two or three dimensional channels

We will consider whether there exists a time periodic solution of the Navier-Stokes equations in two or three dimensional infinite channels. Professor H. Beirao da Veiga has been solved more generalized problems. My material is the special case of his study. But using the condition of the existence of stationary solutions investigated by C. J. Amick, we obtain periodic solutions.

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HERBERT KOCH

Wellposedness and scattering for the KP II equation

The KP-II equation is a two dimensional generalization of the KdV equation. In the talk I will explain a wellposedness result in a critical space, which implies asymptotic stability of the trivial solution. The proof relies on spaces of bounded p variation, which will play a central role in the talk.

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TAKAYUKI KUBO

Stability of stationary avier-Stokes flow in two-dimensional aperture domain.

Let Ω be a two-dimensional aperture domain with smooth boundary. We consider the Navier-Stokes problem with flux condition through the aperture. If the domain Ω is symmetric along the x_2 -axis and if the prescribed constant flux is small enough, Galdi, Padula and Solonnikov and Nazarov independently proved that the existence of the stationary flow (u_s, p_s) with decays like $u_s = O(1/|x|)$ at infinity. We report about its stability. This is a joint work with Prof. Toshiaki Hishida.

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MADS KYED

On the steady motion of elastic bodies in liquids: Coupling of the exterior domain Navier-Stokes problem with the free traction problem of nonlinear elasticity.

I will introduce two problems concerning the motion of an elastic body in a Navier-Stokes liquid. In both cases, I will assume the body occupies a bounded domain and is fully submerged in a liquid occupying the corresponding exterior domain. In the first problem, I will consider a body performing a translatory motion with a constant velocity; the body being held in place by a control body force and a control surface traction. The deformation of the body and the control forces are the unknowns. In the second problem, I will only assume an a-priori known constant body force is applied to the body. In this case, the body may rotate. We are interested in steady motions of the body in this setting. The mathematical context of both problems is the coupling of the steady state exterior domain Navier-Stokes equations with the equations governing the free traction problem of nonlinear elasticity. Due to the a priori unknown deformation of the elastic body, this becomes a free boundary problem. I will outline a proof of existence for both problems. These results were obtained in two joint works with G.P. Galdi.

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MATTHIAS KÖHNE

L_p-Theory for the Navier-Stokes Equations in Domains with Artificial Boundaries

A local well-posedness result in the L_p-setting is developed for the Navier-Stokes equations in combination with a certain class of boundary conditions. This class of boundary conditions arises if domains with artificial boundaries are concerned. Such domains are typically created if the numerical treatment of fluid dynamics implies a truncation of the domain the problem is modeled for. The local well-posedness for the Navier-Stokes equations is obtained by establishing L_p-maximal regularity for the Stokes equations in combination with the boundary conditions in a halfspace and by localization techniques. The result is restricted to a class of boundary conditions, which allow for a local formulation involving the pressure and first order derivatives of the velocity. If the pressure is present in the boundary condition, its uniqueness – not only up to a constant – is ensured.

This is a joint work with Dieter Bothe, RWTH Aachen University, and Jan Pr??, Martin-Luther-Universit?t Halle-Wittenberg.

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YASUNORI MAEKAWA

Asymmetric Burgers vortices at large circulations

The asymmetric Burgers vortices are vortex solutions to the three dimensional stationary Navier-Stokes equations for viscous incompressible fluids in the presence of asymmetric background straining flows. They have been used as a model which expresses tube-like structures of concentrated vorticity fields in turbulence, and they are numerically well investigated especially in the case of large circulation numbers. In this talk some mathematical results are given for the existence of asymmetric Burgers vortices and their asymptotic expansion at large circulation numbers.

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ANCA MATIOC

Radially symmetric growth of nonnecrotic tumors

The growth of tumors is an important subject in the recent research. We present here a model for the growth of nonnecrotic tumors in low-vascularized regims. The corresponding mathematical setting is a free boundary problem. Using ODE techniques we prove existence of a unique radially symmetric stationary solution. Secondly, we prove the stability of this solution. That is, if the initial tumor is radial symmetric, there exists a unique radially symmetric solution of the evolution problem and it converges towards the stationary solution.

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BOGDAN MATIOC

Hele-Shaw flows modelling Stokesian fluids

In a Stokesian fluid the stress tensor is a continuous function of the deformation tensor and the viscosity depends in general nonlinearly on the gradient of the velocity field. The Newtonian fluid is a linear Stokesian fluid for which the viscosity is constant. Non-Newtonian fluids play an important role in industrial processes since many polymer solutions and molten polymers are fluids of that type. Despite their importance in applications, the mathematical understanding of moving boundary problems for non-Newtonian fluids is far from being complete. We consider an n -dimensional periodic flow describing the motion of an incompressible Stokesian fluid in a vertical Hele-Shaw cell. The model is based on a non-Newtonian version of Darcy's law. The corresponding mathematical setting is a fully nonlinear coupled system consisting of a quasilinear elliptic Dirichlet problem for the velocity potential and an evolution equation for the free boundary, i.e. the interface separating the fluid from the air. Combining results from the theory of quasilinear elliptic equations, analytic semigroups and Fourier multipliers one can prove existence of a unique classical solution to the corresponding moving boundary problem. The problem possesses

a single steady-state which attracts at an exponential rate the solutions corresponding to initial data sufficiently close to it.

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SYLVIE MONNIAUX

The Stokes operator with Neumann boundary conditions in Lipschitz domains

In this talk, we investigate the Stokes operator with Neumann-type boundary conditions in Lipschitz domains. We prove that, as it is the case for Dirichlet boundary conditions, this operator generates an analytic semigroup in the space of square integrable divergence-free vector fields. We will as well describe the domain of its fractional powers.

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HIROKO MORIMOTO

Time periodic solution of heat convection equation with nonhomogeneous boundary condition

Let Ω be a bounded domain of \mathbb{R}^n ($n = 2, 3$). The boundary $\partial\Omega$ consists of $N + 1$ smooth connected components $\Gamma_0 \cup \Gamma_1 \cup \dots \cup \Gamma_N$ where $N \geq 1$, Ω being inside of Γ_0 . Let $T > 0$.

We consider the periodic motion of heat convection of incompressible viscous fluid governed by the Boussinesq approximation.

$$(1) \quad \left\{ \begin{array}{ll} \frac{\partial u}{\partial t} = \nu \Delta u - (u \cdot \nabla)u - \nabla p + \eta g \theta + f_1 & \text{in } \Omega \times (0, T) \\ \operatorname{div} u = 0 & \text{in } \Omega \times (0, T) \\ \frac{\partial \theta}{\partial t} = \kappa \Delta \theta - (u \cdot \nabla)\theta + f_2 & \text{in } \Omega \times (0, T) \\ u(x, t) = \beta_0(x, t), \theta(x, t) = \gamma_0(x, t) & \text{on } \partial\Omega \times (0, T) \\ u(x, 0) = u(x, T), \theta(x, 0) = \theta(x, T) & \text{in } \Omega \end{array} \right.$$

If the boundary values β_0 and γ_0 are periodic in t of period T and β_0 has a solenoidal extension satisfying Leray

ś inequality, we obtain time periodic weak solution to the equation (1) for arbitrary η , f_1 and f_2 .

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SARKA NECASOVA

On the motion of several rigid bodies in an incompressible non-Newtonian fluid

The global existence of weak solution of the problem of the motion of several rigid bodies in non-Newtonian fluids will be presented.

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SHINYA NISHIBATA

Relaxation limit of time global solutions to a hydrodynamic model of semiconductors

Several kinds of models are proposed for analysis and device simulation on describing the electron flow through semiconductor devices. Especially the hydrodynamic, the energy transport and the drift-diffusion models are frequently utilized for simulation with the suitable choice subject to the purpose of use of real devices. Hence mathematical analysis on the solvability of these models globally in time and their model hierarchy are important problems not only in mathematics but also in engineering. The hierarchy is formally understood by the limit procedure to make a momentum relaxation time and/or an energy relaxation time tend to zero. The main purpose of this talk is to discuss the solvability of the models and justification of the relaxation limit procedures rigorously.

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JAN PRÜSS

Convergence of Solutions for the Two-Phase Navier-Stokes Problem with Surface Tension

The equilibria of the two-phase Navier-Stokes problem with surface tension without boundary contact are well-known, they form a smooth finite-dimensional manifold. In this talk it is shown that such equilibria are stable, and that solutions starting nearby an equilibrium converge strongly to another probably different steady state. The proof is based on the generalized principle of linearized stability.

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REIMUND RAUTMANN

Approximating vorticity of viscous incompressible flows.

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MICHAEL RENARDY

Short wave stability of inviscid shear flows

The linear stability of inviscid shear flows has been studied extensively over the past century. Discontinuous velocity profile lead to the Kelvin-Helmholtz instability which has unbounded growth rates in the limit of high wave numbers. In contrast, the instabilities in shear flows with smooth velocity profiles appear to be long wave instabilities with a short wave cutoff. We shall give a proof of the existence of such a short wave cutoff.

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JÜRGEN SAAL

Geostrophic Flows with Infinite Energy

For rotating layers as the Ekman boundary layer a well-established mathematical model is given by the Navier-Stokes equations with Coriolis force, considered in a half-space or a layer. The famous so called Ekman spiral, describing the motion inside the boundary layer, is an exact stationary solution to this system. A crucial point is that this special solution has infinite energy. Thus, it appears to be natural to investigate well-posedness and stability of the corresponding model in non-standard classes containing functions with infinite energy. In my talk I therefore intent to present an approach to the Ekman boundary layer problem in spaces of vector-valued Radon measures, which was developed in a joint project with Yoshikazu Giga.

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OKIHIRO SAWADA

local solutions to the Navier-Stokes equations with linearly growing initial data

The local existence and uniqueness of solutions to the Cauchy problem of the Navier-Stokes equations is established when the initial velocity grows linearly. The datum is divided into 2 parts; Lipschitz continuous function and disturbance belonging in some function space. Our main tool is the Ornstein-Uhlenbeck semigroup theory. We also discuss the regularity of solutions when the Lipschitz part is linear. If disturbance part has some nice property, then the global solution is constructed.

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ADELIA SEQUEIRA

Multiscale modelling in hemodynamics

Mathematical and numerical modelling of human physiopathological processes is an extremely complex task that plays a very important role in biomedical research. The problems at hand can involve different physiological systems and the coupling of different mathematical models to capture phenomena that occur at multiple scales in time and space. They are very challenging and often stimulate the use of innovative mathematical and computational techniques.

In this talk some recent mathematical models of the cardiovascular system will be introduced and analyzed. The geometrical multiscale approach, consisting in coupling a hierarchy of models with different levels of complexity and detail will be discussed and some numerical simulations illustrating its effectiveness will be shown. A few test cases of clinical interest will also be presented.

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SENJO SHIMIZU

Local solvability of free surface problems for the Navier-Stokes equations with surface tension

We consider some free boundary problems of a viscous, incompressible fluid with surface tension. We obtained a local in time unique solvability in L_p framework. Our proof is based on an analytic semigroup and maximal regularity theorem of a linearized problem. It is a joint work with Prof. Yoshihiro Shibata.

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KYRIAKOS STAVRAKIDIS

Existence of Solutions of Magnetohydrodynamic Equations

We consider an incompressible Newtonian fluid, which flows around a moving or rotating compact obstacle. Furthermore a magnetic field is impressed. We assume that the boundary is a perfect conductor. This situation can be modelled by the magnetohydrodynamic equations with perfectly conducting wall condition. We will show the existence of a mild solution of this problem. The proof is based on maximal regularity and Kato's iteration.

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TAK TAKAHASHI

Collisions in 3D Fluid Structure interactions problems

We are interested by the contacts between rigid bodies moving into a viscous incompressible fluid. Recently, several studies proved lack of collision in fluid structure systems. E. Zuazua and J.L. Vazquez have proved that no collision can occur between particles for a 1D toy-model. Then, V.N. Starovoitov obtains a criterion for the velocity-field of solutions. Namely, he proves no collision can occur if the gradient of the velocity-field is sufficiently integrable. Finally, two parallel studies by Hesla and Hillairet proved a no collision result when there is only one body in a bounded (or partially bounded) two-dimensional cavity. The aim of the present study is to extend these two-dimensional results to three-dimensional comparable configurations. More precisely we consider the system composed by a rigid ball moving into a viscous incompressible fluid, over a fixed horizontal plane. The equations of motion for the fluid are the Navier-Stokes equations and the equations for the motion of the rigid ball are obtained by applying Newton

's laws. We show that for any weak solutions of the corresponding system satisfying the energy inequality, the rigid ball never touches the plane.

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YOSHIAKI TERAMOTO

Benard-Marangoni problem of heat convection with free surface

Benard-Marangoni heat convection is considered. The Oberbeck-Boussinesq approximation is used for the system and the upper boundary is a free surface with a surface tension which depends on the temperature. Stationary bifurcations and Hopf bifurcations (periodic solutions) are proved to exist depending on the parameters (Rayleigh and Marangoni numbers).

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MATHIAS WILKE

Strong Well-Posedness and Long-Time Behaviour of the Cahn-Hilliard-Gurtin system

We study the existence and uniqueness of global strong solutions of the Cahn-Hilliard-Gurtin system, which is of importance in the theory of phase transitions. We obtain global well-posedness in the sense of L_p . Furthermore we show that each solution converges to a solution of the corresponding stationary system as time tends to infinity.

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PETER WITTEW

Stationary flows in the presence of a wall

We consider the problem of a body moving within an incompressible fluid at constant speed parallel to a wall in an otherwise unbounded domain. This situation is modeled by the stationary incompressible Navier-Stokes equations in an exterior domain in a half space, with appropriate boundary conditions on the body, the wall, and at infinity. We present a proof of existence of solutions for the simplified case where the body is replaced by a force of compact support. The key ingredient is a functional setup that allows for an efficient treatment of problems that involve multiple length scales. This is joint work with Matthieu Hillairet, Universit? de Toulouse, IMT ?quipe MIP, France.

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NORIKAZU YAMAGUCHI

A Stokes approximation of two dimensional exterior Oseen flow near the boundary

We are concerned with stationary Oseen flow and Stokes flow in two dimensional exterior domain. I will report an estimate concerning difference between solution for the Oseen equations and solution for the Stokes equations in the neighbourhood of the boundary.

This talk is based on a joint research with M. Okamura and Y. Shibata at Waseda university.

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MASAO YAMAZAKI

On the unique existence and stability of stationary solutions in the whole plane

We consider the unique existence and stability of the stationary solutions of the Navier-Stokes equation with an external force, which is assumed to be given by a potential with some symmetry.

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TAKU YANAGISAWA

Global DIV-CURL Lemma on bounded domains

We present a global version of the Div-Curl lemma for vector fields on a bounded domain in R^3 with the smooth boundary. In our proof, the Helmholtz-Weyl decomposition for L^r -vector fields on the domain plays an essential role.

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RICO ZACHER

On convergence of solutions to equilibria for quasilinear parabolic problems

We show convergence of solutions to equilibria for quasilinear parabolic evolution equations in situations where the set of equilibria is non-discrete, but forms a finite-dimensional C^1 -manifold which is normally stable. Our results do not depend on the presence of an appropriate Lyapunov functional as in the Lojasiewicz-Simon approach, but are of a local nature. This is joint work with Jan Pr?ss (Halle) and Gieri Simonett (Nashville).

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May 22, 2012