Research Report 2015

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Publications

1) Yoshihiro Shibata, On some free boundary problem of the Navier-Stokes equations in the maximal L_p — L_q regularity class, J. Differential Equations, vol.258 (2015) 4127-4155.
2) Katharina Schade and Yoshihiro Shibata, On strong dynamics of compressible Nematic Liquid Crystals , SIAM J. Math. Anal. Vol. 47, no 5, (2015), 3963-3992.
3) Yoshihiro Shibata, Local well-posedness of free surface problems for the Navier-Stokes equations in a general domain, Discrete and Continuous Dynamical Systems Series S, vol.9, no.1, (2016) ,315-342.

Talks

1) Title : Two Phase Problem,
Mathematical Fluid Mechanics, Old Problems, New Trends, Banach Center Porland, August 30 – September 5, 2016
2) Title : The global well-posedness for the compressible viscous fluid flow in 3D exterior domains,
Mathflows 2015, Porquerolles, September 13-18 2016.
3) Title : Global well-posedness for some two phase problem: compressible-compressible case,
MSJ Autumn Meeting 2015, Kyoto Sangyo University, September 16, 2015.
4)Title : Global well-posedness of some free boundary problem for the Navier-Stokesequations in an exterior domain,
International Conference SPP 1506 Transport Processes at Fluidic Interfaces, IRTG 1529 Mathematical Fluid Dynamics, Technischen Universität Darmstadt, October 5-8 2015.
5) Title : On some one phase problem with surface tension,
Nagoya DE Seminar、Nagoya University, December 14, 2015.
6) Title : On L_p—L_q maximal regularity and free boundary problem for the viscous fluid flows (in Japanese)
Keynote address in the conference on the general study of differential equations, December 19, 20, 2015, Tokyo University.
7) Title : Two Phase Problems for Viscous Fluids,
Classic and Stochastic Geometric Mechanics, Winter School at Imperial College,

London, January 1-4, 2016.

8) Title : A Modelling of some two phase problem, The 33th Kyusyu Symposium on Partial Differential Equations, Kyusyu University, January 27-29 2016.

9) Title : On a global well-posedess for the free boundary problem of the Navier-Stokes equations
Free Bounary Problems in Fluid and Plasma Dynamics, Nara Women's University, February 3-4, 2016.

10) Title : On the free boundary problem for the Navier-Stokes equations with surface tension,
The 16th International Conference, The Navier-Stokes Equations and Rlated Topics, Nagoya University, March 7-11, 2016.

11) Title: On the uniequ existence of global in time solutions of the compressible viscous fluid flow (in Japanese)
MSJ Annual meeting, University of Tsukuba, Marth 18, 2016. (Speaker: Yuko Enomoto, Shibaura Instutute of Technology)

Conference Organized:

1) International Workshop on the Multi-Phase Flow; Analysis, Modelling and Numerics, Waseda University, November 10-13, 2015.

2) Mathematical analysis of incompressible viscous flows (in Japanese), Research Institute for Mathematical Science Kyoto University, November 16-18, 2015.

Research Resuls:

1) We proved the unique existence of a global in time solution of the free boundaryproblem for incompressible viscous fluids and one phase problems in bounded domains without surface tension.

2) We studied the free boundary problem for the Stokes equation in general domains, which is derived as the linearized problem of the free boundary problem for incompressible viscous fluids with surface tension and we proved existence of an R-bounded solution operator of the generalized resolvent problem and applied this result to prove the maximal regularity for the time evolution problem. This completes the general theory of the linearized problems in one phase problems except the case of exterior domains.

3) We proved the unique existence of a local in time solution of the free boundary

problems for incompressible viscous fluid and the one phase problem in general domains.

4） We studied the compressible case of the Nematic Liquid Crystal and we proved the unique existence of a local in time solution in general domains and the unique existence of a global in time solution in bounded domains.

5） We proved the unique existence of a global in time solution of the Nematic Liquid Crystal in the whole Euclidean space in the incompressible fluid case.. This work is the first attempt to exploit the maximal regularity to show existence of a global in time solution in the unbounded domain case.

6） We proved the unique existence of a global in time solution with H^2 initial data and successfully calculated the best order of the decay estimates of the solution of the equation for compressible viscous fluids in exterior domains under the Non-slip condition in R^3. This work improves earlier results by Matsumura-Nishida, where the global in time unique existence theorem was obtained for the H^3 initial data, upon the regularity of initial data.

7） We established the maximal regularity theorem for the thermo-plate equation with free boundary condition in general domains.