

2017 Taiwan-Japan Workshop on Dispersion, Navier Stokes, Kinetic, and Inverse Problems

(2017 台日分散、流體動力學、與反問題研討會)

Date: Dec. 22 2017 ~ Dec. 25 2017

Venue: Department of Mathematics, National Cheng Kung University

WebPage: http://www.ncts.ntu.edu.tw/events_2_detail.php?nid=162

Registration : <https://goo.gl/forms/gQ8v3xcSquFhSjdU2>

Speakers from Taiwan:

National Center for Theoretical Sciences:

Kazuo Aoki,

National Taiwan University:

Chun-Hsiung Hsia, I-Kun Chen

National Chiao Tung University:

Hsin-Yuan Huang,

Tunghai University:

 Chueh-Hsin Chang,

National Chung Cheng University:

Bo-Chih Huang,

National Cheng Kung University:

Wen-Ching Lien, Hung-Wen Kuo,

Kung-Chien Wu, David Yang, Pu Zhao Kow,

National University of Kaohsiung:

Ying-Chieh Lin,

Speakers from Japan:

Tokyo University of Science:

Keiichi Kato, Takahisa Inui,

Keio University:

 Masahiro Ikeda,

Nagoya Institute of Technology:

Masahiro Suzuki,

Okayama University of Science:

Kota Uriya,

Osaka University:

Gaku Hoshino, Tomoya Kato, Kazuyuki Tsuda,

Kobe University:

 Yoshihiro Ueda,

Kyushu University:

 Ryo Takada,

Saga University:

 Takamori Kato,

Organizers:

Yung-fu Fang (NCKU),

Ching-Lung Lin (NCKU),

Yoshio Tsutsumi (Kyoto Univ)

Nakao Hayashi (Osaka Univ)

Kenji Nakanishi (Osaka Univ)

Sponsors: NCTS, NCKU, and NSCMRPC

2017 Taiwan-Japan Workshop on Dispersion, Navier Stokes, Kinetic, and Inverse Problems

2017/12/22 ~ 2017/12/25 at NCKU, Tainan, Taiwan

Program

Friday (12/22)

Saturday (12/23)

Sunday (12/24)

Monday(12/25)

Chair:		Chair:	
0900~0950	Ryo Takada	0900~0950	Kazuo Aoki
0955~1035	Gaku Hoshino	0955~1035	Kung-Chien Wu
1035~1050	Break	1035~1050	Break
Chair:		Chair:	
1050~1130	Tomoya Kato	1050~1130	Hung-Wen Kuo
1135~1215	Kazuyuki Tsuda	1135~1215	I-Kun Chen
1215~1400	Lunch	1215~1400	Lunch
Chair:	Jyh-Hao Lee	Chair:	Hsi-Wei Shih
1400~1440	Masahiro Suzuki	1400~1440	Hsin-Yuan Huang
1445~1525	Takamori Kato	1445~1525	Chueh-Hsin Chang
1525~1545	Group Photo Break	1525~1545	Group Photo Break
Chair:		Chair:	Yu-Yu Liu
1545~1625	Masahiro Ikeda	1545~1625	Yoshihiro Ueda
1630~1710	Bo-Chih Huang	1630~1710	Wen-Ching Lien
1715~1755	Ying-Chieh Lin	1715~1755	Willie Hsia
1800~1815	Pu Zhao Kow	1800~1815	David Yang

0900~1200	Informal Discussion
1200~1400	Lunch
1400~1800	Informal Discussion

1500~1550	Registration
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1550~1600	Opening Ceremony
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Chair:	Ching-Lung Lin
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1610~1710	Keiichi Kato
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1715~1755	Kota Uriya
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1800~1840	Takahisa Inui
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便當

梅鑫海產

周氏蝦捲

台南擔子麵

上海小籠湯包

如意樓-林森-東豐

Banquet

農舍餐廳

杰的食堂

三采日式料理

1830

雨荷舞水

老鄧牛肉麵

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Talk titles and abstracts:

Friday (12/22)

Keiichi Kato <kato@ma.kagu.tus.ac.jp>, Tokyo University of Science,

Title: Wave packet transform and its application to Schrödinger equations

Abstract: We introduce wave packet transform with time dependent wave packet and apply it to Schrödinger equations. Taking suitable time dependent wave packet, we can transform Schrödinger equations to 1st order partial differential equations with lower term, which is easy to solve or to transform integral equations. Using this formula, we discuss

- 1) estimates of solutions in modulation spaces.
- 2) to determine singularities of solutions by initial function.

Kota Uriya <uriya@xmath.ous.ac.jp>, Okayama Univ of Science,

Title: Long range scattering for NLS with critical homogeneous nonlinearity in 3D

Abstract: In this talk, we consider large time behavior of solutions to nonlinear Schrödinger equation (NLS) $i\partial_t u + \Delta u = F(u)$: Here, $(t; x)$ in \mathbb{R}^{1+3} and $u = u(t; x)$ is a complex-valued unknown function. We suppose that the nonlinearity F is homogeneous of degree $1 + 2/3$, that is, F satisfies $F(\lambda u) = \lambda^{1+2/3}F(u)$ for any u in C and $\lambda > 0$. A

typical example is $F(u) = \mu|u|^{p-1}u$ ($\mu \in \mathbb{R} \setminus \{0\}$). The exponent $p = 1 + 2/d$ is known as the critical in the sense of long time behavior of the solution in \mathbb{R}^d . In [2], Masaki and Miyazaki considered the problem in one and two dimensions and gave a sufficient condition on the nonlinearity for that the corresponding equation admits a solution that behaves like a free solution with or without a logarithmic phase correction. Their argument is based on Fourier series expansion of the nonlinearity into a sum of a resonant part and a harmless non-resonant part. We here focus on the study of the three-dimensional case, in which it is required that a solution converges to a given asymptotic profile with a faster rate than in the lower dimensional cases. To obtain the necessary convergence rate, we employ the end-point Strichartz estimate and modify a time-dependent regularizing operator which is introduced in [2]. This regularizing operator is a development of one firstly used in Hayashi-Wang-Naumkin [1]. Moreover, we present a candidate of the second asymptotic profile to the solution, which is originally found in Moriyama-Tonegawa-Tsutsumi [4]. This is

a joint work with S. Masaki (Osaka University) 2 and H. Miyazaki (National Institute of Technology, Tsuyama College) 3.

References

- [1] Nakao Hayashi, Huimei Wang, and Pavel I. Naumkin, Modified wave operators for NLS in lower order Sobolev spaces, J. Hyperbolic Differ. Equ. 8 (2011), no. 4, 759-775. MR2864547
- [2] Satoshi Masaki and Hayato Miyazaki, Long range scattering for NLS with general homogeneous nonlinearity, preprint (2016), available at arXiv:1612.04524.
- [3] Satoshi Masaki, Hayato Miyazaki, and Uriya Kota, Long range scattering for NLS with critical homogeneous nonlinearity in 3D, preprint (2017), available at arXiv:1706.03491.
- [4] Kazunori Moriyama, Satoshi Tonegawa, and Yoshio Tsutsumi, Wave operators for the NLS with a nonlinearity of low degree in one or two-D, Commun. Contemp. Math. 5(2003), 983-996. MR2030566

Takahisa Inui <inui@rs.tus.ac.jp>, Tokyo Science Univ.,

Title: The sharp upper estimate of the lifespan for the semilinear wave equation with time-dependent damping

Abstract: We consider the semilinear wave equation with time-dependent damping. Recently, Lai and Zhou obtained the sharp upper estimate of the lifespan in the classical (time-independent) damping case when the order of nonlinearity is the Fujita exponent. We expand their result to a time-dependent damping case. This is a joint work with Dr. Masahiro Ikeda (RIKEN).

Saturday (12/23)

Ryo Takada, Kyushu University, (Boussinesq equations for rotating fluids)

<takada@math.kyushu-u.ac.jp>

Title: Dispersive estimates for the stably stratified Boussinesq equations

Abstract: We consider the initial value problem for the 3D Boussinesq equations for stably stratified fluids without the rotational effect. We establish the sharp dispersive estimate for the linear propagator related to the stable stratification. As an application, we give the explicit relation between the size of initial data and the buoyancy frequency which ensures the unique existence of global solutions to our system.

Gaku Hoshino <g.hoshino@cr.math.sci.osaka-u.ac.jp>, Osaka Univ (analyticity for NLS)

Title : Analytic smoothing effect for the nonlinear Schrödinger equations without square integrability

Abstract: We consider the local Cauchy problem for the nonlinear Schrödinger equations (NLS) with data which belong to L^p not in L^2 ; $1 < p < 2$: NLS with non-linearity $|u|^{2m}u$; $m \in \mathbb{N} \setminus 0$ has analytic smoothing effect if data belong to exponentially weighted L^2 -space (T. Ozawa and K. Yamauchi, (2010), G. Hoshino. and T. Ozawa, (2014)). If data decay exponentially in L^q with $2 < q \leq \infty$, then which also decay exponentially in L^2 : Therefore the Cauchy problem with data which belong to exponentially weighted L^q ; $2 < r \leq \infty$ is regarded as the Cauchy problem in L^2 -framework, essentially. However

there exists φ in L^p not in L^2 ; $1 < p < 2$ such that $\sup_{\delta \in D} \|e^{\delta \cdot x} \varphi\|_{L^p} < \infty$ for suitable domain D in \mathbb{R}^n (typical example is $D = (-1; 1)^n$). In this talk, we study the analytic smoothing effect in L^p -setting with $1 < p < 2$: This study is based on joint work with Professor Ryosuke Hyakuna from Waseda University, Japan.

Tomoya Kato <t.katou@cr.math.sci.osaka-u.ac.jp>, Osaka Univ (LWP in modulation spaces)
Title : Well-posedness for the 3D generalized Zakharov-Kuznetsov equation on modulation spaces

Abstract: In this talk, we consider the well-posedness for the generalized 3-D Zakharov-Kuznetsov equation on modulation spaces. In order to obtain the well-posedness, some linear estimates play important roles. We mainly focus on maximal function estimates and establish the estimate in the frame of modulation spaces. As an application, we obtain the well-posedness in $M_{2,1}^0$ for $m \geq 4$ which is the result in a new class of functions which is not treated by that in the scaling critical Sobolev spaces.

Kazuyuki Tsuda <jtsuda@sigmath.es.osaka-u.ac.jp>, Osaka Univ (periodic sol for compressible NS)

Title : Time periodic problem for the compressible Navier-Stokes equation on 2-D whole space with antisymmetry

Abstract:

We consider time periodic problem for the compressible Navier Stokes equation (CNS) on 2-D whole space. Ma, Ukai, and Yang (2010) studied the time periodic problem on the whole space. It was shown that if the space dimension is greater than or equal to 5, there exists a time periodic solution for a sufficiently small time periodic external force. Furthermore, the time periodic solution is stable under sufficiently small initial perturbations and the time decay rate of the perturbation is obtained. Therefore it had been problem to solve the time periodic problem in lower dimensional case. Kagei-T (2015) showed that when the space dimension is greater than or equal to 3 we have the existence and stability of a time periodic solution for sufficiently small time periodic external force with some symmetry.

As for the result without assuming the symmetry condition for CNS, T (2016) showed that there exists a time periodic solution for small time periodic external force when the space dimension is greater than or equal to 3. In addition, we obtain the asymptotic stability of the time periodic solution for sufficiently small initial perturbation.

In this talk it is stated that there exists a time periodic solution to CNS on 2-D whole space for small time periodic external force satisfying antisymmetry condition. The antisymmetry condition was used in the stationary problem for incompressible Navier-Stokes equation. Furthermore, the existence of stationary solution to CNS for the stationary problem is also stated under small external force having the antisymmetry in two dimensional case.

Masahiro Suzuki <masahiro@nitech.ac.jp>

Title: Quasi-neutral limit for the Euler-Poisson system

Abstract: The purpose of this talk is to mathematically discuss the formation of a plasma sheath near the surface of materials immersed in a plasma, and to study qualitative information of such a plasma sheath layer. Specifically, we study the quasi-neutral limit of solutions to the Euler-Poisson system in a three-dimensional annular domain by establishing L^2 and H^1 estimates of the difference between the solutions to the Euler-Poisson system and its quasi-neutral limiting system, incorporated with the correctors for the boundary layers. The pointwise estimate of correctors enables us to obtain the thickness of boundary layers.

Takamori Kato <tkkato@cc.saga-u.ac.jp>, Saga University, (the fifth order mKdV equation)

Title: Well-posedness in low regularity of fifth order KdV type equations with periodic boundary condition

Abstract: We consider the well-posedness for the Cauchy problem of the fifth order KdV equation in the periodic setting. This is one of KdV hierarchies discovered by Lax and is completely integrable.

In this study, it is the most important how to recover some derivative losses included in nonlinear terms. To overcome this issue, we focus on the algebraic structure of the fifth order KdV equation. In fact, we use conserved quantities and gauge-like transformation to cancel the resonant parts with derivative losses and apply the normal form reduction to the non-resonant parts to recover derivative losses to obtain the optimal result in some sense. This talk is based on a joint work with Kotaro Tsugawa (Nagoya University).

Masahiro Ikeda <masahiro.ikeda@riken.jp>

Title: Lifespan of blow-up solutions to semilinear wave equation with space-dependent critical damping

Abstract:

We introduce our recent small data blow-up result and give an upper estimate for Cauchy problem to the wave equation with critical space-dependent damping term $V_0|x|^{-1}$ and a p -th order power nonlinearity in d -dimensional Euclidean space, where $d \geq 3$, $\frac{d}{d-1} < p \leq p_S(d + V_0)$, where $p_S(d)$ is the Strauss exponent for the semilinear wave equation without damping.

Our main idea for the proof is due to the technique of test functions for the wave equation without damping originated by Zhou-Han (2014). Moreover, we give a new threshold value $V_0 = \frac{(d-1)^2}{d+1}$ for the coefficient of critical and singular damping $|x|^{-1}$.

This is a joint work with Motohiro Sobajima (Tokyo University of Science).

Bo-Chih Huang (黃博峙) <huangbz@ccu.edu.tw>, National Chung Cheng University

Title: The traveling pulse of Keller-Segel system with nonlinear chemical gradients and small diffusions

Abstract: We consider the Keller-Segel system with nonlinear chemical gradient and small cell diffusion. We will discuss the existence and instability of traveling pulse solutions for the system. The existence of the traveling pulses is established by the geometric singular perturbation theory and trapping regions. We also consider the linear instability of these pulses by the spectral analysis of the linearized operators. (This talk is based on a joint work with Chueh-Hsin Chang, Yu-Shuo Chen, and John M. Hong)

Ying-Chieh Lin (林英杰) <liny@nuk.edu.tw> National University of Kaohsiung

Title: Concentration of source terms in generalized Glimm scheme for global entropy solutions of nonlinear hyperbolic balance laws

Abstract:

In this talk, we investigate the Cauchy problem for a nonlinear hyperbolic system of balance laws with sources $a_x g$ and $a_t h$. To get the approximate solutions of our problem, we consider a version of generalized Riemann problem that concentrates the variation of a on a thin T-shaped region of each grid. A new version of Glimm scheme is introduced to construct the approximate solutions and its stability is proved by considering two types of conditions on a . Finally, we verify the consistency of the scheme and the entropy inequality to establish the global existence of entropy solutions.

Pu Zhao Kow (邱普照), NCKU <kow4896@gmail.com>

Title: Schauder's Estimates and Asymptotic Behavior of Solutions of the Stationary Navier-Stokes Equation in an Exterior Domain

Abstract:

In this paper, we improve the result in [1], which concern about the asymptotic behavior of an incompressible fluid around a bounded obstacle. Under some assumptions weaker than [1], any nontrivial velocity field obeys a minimal decaying rate $\exp(-C|x|^{-3/2} \log|x|)$ at infinity. Our proof is based on appropriate Carleman estimates and the regularity result, namely the Schauder's estimate for stationary Navier-Stokes equation.

Reference:

[1] Lin, Ching-Lung; Uhlmann, Gunther; Wang, Jenn-Nan, Asymptotic behavior of solutions of the stationary Navier-Stokes equations in an exterior domain. Indiana Univ. Math. J. 60 (2011) no. 6, 2093-2106.

Sunday (12/24)

Kazuo Aoki <kazuo.aoki.22v@st.kyoto-u.ac.jp>, NCTS, NTU, NCKU

Title : Shock wave structure for polyatomic gases with large bulk viscosities

Abstract: The structure of a standing plane shock wave in a polyatomic gas is investigated on the basis of kinetic theory, with special interest in gases with large bulk viscosities, such as the CO₂ gas. The polyatomic version of the ellipsoidal statistical model is employed, and the shock structure is obtained numerically for different upstream Mach numbers and for different (large) values of the ratio of the bulk viscosity to the shear viscosity. The double-layer structure consisting of a thin upstream layer with a steep change and a much thicker downstream layer with a mild change is obtained. An analytical solution, consisting of a jump condition and a slowly varying solution, that can approximate the double-layer structure well is also presented. (joint work with Shingo Kosuge, Kyoto University).

Kung-Chien Wu (吳恭儉) <kungchienwu@gmail.com>

Title: How to solve Fokker-Planck equation explicitly?

Abstract: In this talk, we will present how to solve the Green function of the Fokker-Planck equation with flat confinement. We have the pointwise estimate of the Green function. This is a joint work with Yu-Chu Lin and Haitao Wang.

Hung-Wen Kuo (郭鴻文) <hwkuo@mail.ncku.edu.tw> ,

Title: Effect of abrupt change of the wall temperature in the kinetic theory

Abstract: We investigate the response of a dilute gas to the abrupt change of the temperature of the bounding wall on the basis of the Boltzmann equation. Consider a semi-infinite expanse of a rarefied gas with density ρ_0 bounded by an infinite plane wall. The gas is initially in equilibrium with the bounding gas at temperature T_0 . We study the asymptotic behavior of the gas when the temperature of the wall is suddenly changed to T_w at time $t = 0$ and then is kept constant. We show that for short times the solution represents a perturbation to the linearized free molecular flow. We also obtain the asymptotic expansion of the solution for large times.

I-Kun Chen (陳逸昆) <ikun.chen@gmail.com> ,

Title : Regularity for diffuse reflection boundary problem to the stationary linearized Boltzmann equation in a convex domain

Abstract: We consider the diffuse reflection boundary problem for linearized Boltzmann equation for hard sphere potential, cutoff hard potential, or Maxwellian molecular gases in a C^2 strictly convex bounded domain. We obtain a pointwise estimate for the derivative of the solution provided the boundary temperature is bounded differentiable and the solution is bounded. (joint work with Chun-Hsiung Hsia and Daisuke Kawagoe.) -----

Hsin-Yuan Huang (黃信元) <hsinyuanh@gmail.com>, National Chiao Tung University

Title: Bubbling Phenomenon in the Chern-Simons system with two Higgs particles.

Abstract:

In this talk, I will briefly introduce the recent developments in the Abelian Chern-Simons system with two Higgs particles. In particular, ..I will focus on the bubbling phenomenon in this system, including necessary and sufficient conditions for the existence of bubbling solutions.

Chueh-Hsin Chang (張覺心) <changjuexin@thu.edu.tw>

Title: Stability of traveling wave solutions for a diffusive competition system of 3 species

Abstract: The difference between the competition system of two and three species is that the former cannot coexist while the later can coexist in some cases. It is difficult to find patterns in three species competition system due to the lack of maximum principles. In this talk, we study special kinds of three species competition systems in which the existence and stability of monotone traveling waves can be obtained. The equations can be transformed into a monotone system and then we can use the techniques of sup-sub-solutions to obtain existence of solutions. We can also find the stability by spectral analysis and asymptotic behaviors of the traveling waves.

Yoshihiro Ueda <ueda@maritime.kobe-u.ac.jp>

Title: New stability criterion for the general linear system with regularity-loss structure

Abstract:

In this talk, we introduce a new approach to obtain the property of the dissipative structure for a system of differential equations. If the system has a viscosity or relaxation term which possesses symmetric property, Shizuta and Kawashima (1985) introduced a suitable stability condition for the corresponding eigenvalue problem of the system, and derived the detailed relation between to the coefficient matrices of the system and the eigenvalues.

However, there are some complicated physical models which possess a non-symmetric viscosity or relaxation term and we can not apply this stability condition to these models. Under this situation, our purpose is to extend the stability condition for complicated models and make the relation between to the coefficient matrices and the corresponding eigenvalues clear. Furthermore, we shall explain the new dissipative structure by using the several concrete examples.

Wen-Ching Lien (連文璟) <wlien@mail.ncku.edu.tw>,

Title: Self-similarity and Symmetry Analysis on Differential Equations

Abstract:

Objects of the natural world universally exhibit some form of symmetry. Knowledge of the symmetries inherent in the physical laws can be used to understand complex physical phenomena, to simplify and solve problems. In this talk, we will apply the methods of symmetry analysis to solve some problems of ODEs and PDEs.

Chun-Hsiung Hsia (夏俊雄) <willhsia@math.ntu.edu.tw>,

Title : On the mathematical analysis of synchronization

Abstract :

In this talk, we shall give a concise overview of the synchronization problem by summarizing a few important features which can be demonstrated by the Kuramoto oscillators. A brief historic account is also included. We shall also present some new results based on our recent work.

This is joint work with Bongsuk Kwon and Chang-Yeol Jung.

David Yang (楊大緯), NCKU <l18051015@mail.ncku.edu.tw>

Title :

Abstract:
