Mathematics and Physics Unit “Multiscale Analysis, Modelling and Simulation”
Top Global University Project, Waseda University

Workshop on Hyperbolic and Parabolic Systems

Date: December 19, 2017
Venue: Large Conference Room, 1st Floor, 55N Bldg., Waseda University, Nishi-Waseda Campus
早稲田大学 西早稲田キャンパス 55 号館 N 棟 1 階 大会議室

Yu Shih-Hsien (National University of Singapore)

10:30 – 12:00

Pointwise estimate for compressible Navier-Stokes

In this talk we will demonstrate the construction of a Green’s function of a compressible Navier-Stokes equation and its application to construct the solution for piecewise smooth initial data.

Yoshinori Morimoto (Kyoto University)

13:30 – 14:30

Revisit on the Boltzmann equation for Debye-Yukawa potential

It is well-known that the kernel of the Boltzmann collision integral operator has a non-integrable fractional singularity with respect to the deviation angle by the collision, when the interactive potential of particles obeys the inverse power law, ρ^{1-n}, $n > 2$, where ρ is the distance between two particles. In 2009, S. Ukai, C.-J. Xu, T. Yang, and I proposed another kernel with much weaker singularity of logarithmic type, when the interaction is Debye-Yukawa type, $\rho^{-1}e^{-\rho^s}$, $0 < s < 2$, and we showed the smoothing effect of solutions to the Cauchy problem of the spatially homogeneous Boltzmann equation for a further simplified kernel that does not depend on the relative velocity of two particles. In this talk, we consider the same smoothing effect for a more physically rigorous model coming from the Debye-Yukawa type potential. This is a joint work with Shuaikun Wang and Tong Yang.

Shinya Nishibata (Tokyo Institute of Technology)

14:40 – 15:40

Asymptotic stability of a rarefaction wave for symmetric hyperbolic-parabolic systems

In the present talk, we discuss a large time behavior of a solution to a coupled system of viscous and inviscid conservation laws. We, mainly, talk about an asymptotic stability of a rarefaction wave under the assumption that the existence of an entropy function. This condition enables us to transform the original system to a normal form of symmetric hyperbolic-parabolic systems. In asymptotic analysis, we derive an a priori estimate by an energy method. In order to derive the basic estimate, we make use of an energy form, which is obtained by substituting a smooth approximation of the rarefaction wave in the entropy function. The symmetric system is utilized in deriving the higher estimates of the 1st and 2nd derivatives of solutions. In this procedure, we have to suppose that the stability condition hold at spatial far field.

15:40 – 16:10　Coffee break

Tohru Nakamura (Kumamoto University)

16:10 – 17:00

Viscous shock wave and singular limit for some hyperbolic system with relaxation

In this talk, we consider large time behavior of solutions to scalar conservation laws with an artificial heat flux term. In the case where the heat flux is governed by Fourier's law, the equation is scalar viscous conservation laws. In this case, existence and asymptotic stability of one-dimensional viscous shock waves have been studied. The main concern in the current talk is a 2×2 system of hyperbolic equations with relaxation which is derived by prescribing Cattaneo's law for the heat flux. We consider the one-dimensional Cauchy problem for the system of Cattaneo-type and show existence and asymptotic stability of viscous shock waves. We also obtain the convergence rate by utilizing the weighted energy method.　By letting the relaxation time zero in the system of Cattaneo-type, the system is formally deduced to scalar viscous conservation laws of Fourier-type. This is a singular limit problem which occurs an initial layer. We also consider the singular limit problem associated with viscous shock waves.

Yoshihiro Ueda (Kobe University)

17:10 – 18:00

New stability criterion for the dissipative linear system in whole space

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-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.

18:00 –　　Reception

Organized by Tohru Ozawa
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