Working scheme (研究計画の英訳)

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Up to now, we study the large-time behavior of solutions to an initial-boundary value problem for scalar viscous conservation law in one dimension space. From now on, we will study viscous conservation law with more general flux and higher dimensional spaces.

Generalization of flux

Since the flux of conservation law in mathematical model is generally not necessarily convex, the generalization of the flux is one of the important mathematical theme. I showed in [1] that the asymptotic stability of superpositions of stationary wave and rarefaction wave. On the other hand, the asymptotic stability of superpositions of self-similar solution and rarefaction wave is proved by Yoshida-Matsumura recently. I will develop these two results and investigate the asymptotic stability of superpositions of three waves "stationary wave and self-similar solution and rarefaction wave" by applying the characteristic curve method and weighted energy method. For this purpose, I think it is important to derive the interactive speed of these three waves.

Application to higher dimensional space

Previously, I derived only one dimensional space. I will apply my work to the problem of higher dimensional problem. For the multi-dimensional viscous conservation laws, Xin ('90) and Nishikawa-Nishihara ('99) showed the asymptotic stability of planar rarefaction wave. On the other hand, Goodman ('89) and Goodman-Miller ('99) showed the asymptotic stability of planar shock wave. I will apply there result to the initial-boundary problem on exterior domain. For this purpose, we start with the simple situation. Specifically, we think the flux of viscous conservation law as one of Euler equation. Under this situation, we consider the asymptotic stability of rarefaction wave and shock wave. In this case, I anticipate that the height of rarefaction wave and shock wave go down as radius tends to infinity. To prove this, I define the condition for which the shock wave and the rarefaction wave exists by applying L^2-energy method.

Application to reaction-diffusion equation

In connection with conservation law, the problem with nonlinear term of power function is intriguing question. In general, it is known that the solution of the problem with nonlinear term blow up. We are investigating the Fujita equation in two dimensional spaces. Although there is many researches for the spherically symmetric solution in two dimensional spaces, existence of non-spherically symmetric solution has not been investigated. To prove this, since it is difficult to apply the mathematical method directly, we start with the application of numerical calculation method. Concretely speaking, we now simply calculate by using the Newton method. In the future, by adapting the Bessel transformation method, we treat the behavior on far field in detail. (joint research with Professor Kenta Kobayashi)