Research plan

Yoshinori Nishii

I am planning to continue the studies on nonlinear hyperbolic and dispersive equations under the Agemi-type structural conditions or more general weak null conditions.

Through the previous studies mentioned in the separate sheet, we already know that some class of nonlinear wave and Schrödinger equations can be reduced to some simpler ordinary differential equations (called the "profile equations") up to harmless remainder terms, and that the large time asymptotic behavior of the original solutions can be better-understood through the analysis of the profile equations. In this point of view, the following three are the main plans.

(1) My first research plan is to develop the studies on the optimal decay rates further. The key in my previous studies on the optimality of the decay rates is to solve the profile equations explicitly. So I believe that this idea could be useful to verify the optimality of the decay rates of solutions to nonlinear wave and Schrödinger equations with strongly dissipative structure, such as Katayama-Wakasa-Yordanov, Ogawa-Sato and others.

(2) According to the recent works by Kim-Sunagawa, Masaki-Segata-Uriya and others, similar approach turns out to be useful in the analysis of nonlinear Klein-Gordon equations, which have intermediate properties between wave and Schrödinger equations. So I believe that the methods developed by my previous studies could be also effective to reveal the weakly dissipative structure in nonlinear Klein-Gordon equations. This is the second plan.

(3) My next challenge is to develop it further so that it can be applied to other kind of nonlinear structure beyond the dissipative structure, such as the conditions introduced by Alinhac, Katayama-Kubo and others for the semilinear wave equations, or by LeFloch and his school for wave-Klein-Gordon systems.

Based on these studies, my final goal is to give a unified perspective to nonlinear hyperbolic and dispersive equations beyond the types of equations, and to find clues to a deeper understanding of various wave propagation phenomena and nonlinear problems.