國立交通大學應用數學系
學術演講公告

主講人：Dr. Yuki Chino (NCTS)

講　題：A crossover for Random Walk in Cooling Random Environment

時　間：109 年 3 月 31 日(星期二) 下午 13:20 –14:10

Abstract

Random Walk in Random Environment (RWRE) was introduced by biophysicists Chernov and Temkin to understand the mechanism of DNA replication. In mathematical literature, Solomon first considered the model in his thesis and obtained some results for the criterion between recurrence and transience and the law of large numbers. One-dimensional Random Walk in Cooling Random Environment (RWCRE) is obtained as a patchwork of one-dimensional RWRE by resampling the environment along a sequence of deterministic times. The RWCRE model can be seen as a model that interpolates between the classical static model and the model with i.i.d. sampling every unit of time. The latter model is called Random Walk in Dynamic Random Environment (RWDRE), which shows some localization or homogenization, depending on the choice of the dynamics. In the RWCRE model, we can tune the dynamics to control its asymptotic behavior.

In this talk, we have some results about the asymptotic behavior of RWCRE. We investigate how the recurrence versus transience criterion known for RWRE changes for RWCRE. We also explore the fluctuation for RWCRE when RWRE is either recurrent or satisfies a classical central limit theorem (CLT). We also show that the strong law of large numbers (SLLN) and the large deviation principle (LDP) for RWCRE are the same as those for RWRE under a certain condition for the resampling, which means some form of localization. However, the first two results (criterion and fluctuations) are different from those for RWRE. We can see a crossover of the limit distribution in the recurrent regime, i.e., between so-called Sinai-Kesten distribution, which is a typical one of RWRE, and Gaussian distribution, which is typical for homogeneous RW. This implies a crossover between localization and homogenization.

This talk is based on a joint work with L. Avena (Leiden University), C. da Costa (Durham University) and F. den Hollander (Leiden University)..

主講人：郭鴻文教授 (成功大學數學系)

講　題：A kinetic model for a polyatomic gas with temperature-dependent specific heats and its application to shock-wave structure

時　間：109 年 3 月 31 日(星期二) 下午 14:20 –15:10

Abstract

We establish a new kinetic model of the Boltzmann equation for a polyatomic gas with temperature dependent specific heats.

It is an extension of the ellipsoidal statistical (ES) model for a gas with constant specific heats.

We prove the basic properties of the new model equation such as the equilibrium solution, the conservation laws, and the space-homogeneous H-theorem. The formulas of viscosity, bulk viscosity, and thermal conductivity are also derived from the model equation by the Chapman-Enskog expansion. Then, the new model equation is used to investigate the structure of a plane shock wave with special interest in the carbon dioxide gas, which is known to have a very large bulk viscosity, and in the case of relatively strong shock waves. From the numerical and analytical results, the effect of temperature-dependent specific heats is clarified. This is a joint work with Shingo Kosuge and Kazuo Aoki.

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