72th Kyoto Ekimae Seminar
第 72 回　京都駅前セミナー

July 13th, 2018
Venue: Room 7, 6th-floor, Campus Plaza Kyoto,
The Consortium of Universities in Kyoto
http://www.consortium.or.jp/about-cp-kyoto/access

Program

July 13 (Friday)

14:00 – 15:00 **Kensuke Ohtake (太田家 健佑)** (Osaka University)
"A Mathematical analysis on a system of nonlinear integral differential equations in economic geography"

15:00 – 15:20 Discussions

15:20 – 16:20 **Ján Eliaš** (University of Graz)
"On a Lotka-Volterra reaction-diffusion-ODE system with the superimposed interaction between two Neolithic populations I"

16:20 – 16:40 Discussions

16:40 – 17:40 **Ján Eliaš** (University of Graz)
"On a Lotka-Volterra reaction-diffusion-ODE system with the superimposed interaction between two Neolithic populations II"

17:40 – 18:00 Discussions

18:00 – **Free discussions and dinner party**

Organized by
Tatsuki Kawakami (川上竜樹) (kawakami@math.ryukoku.ac.jp)
Yoshihisa Morita (森田善久) (morita@rins.ryukoku.ac.jp)
Shoji Yotsutani (四ッ谷晶二) (shoji@rins.ryukoku.ac.jp)
Ryukoku Center for Mathematical Sciences (龍谷数理科学センター)

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========== See abstracts in the next page ==========

A Mathematical analysis on a system of nonlinear integral differential equations in economic geography

Kensuke Ohtake (太田家 健佑)

Center for Mathematical Modeling and Data Science, Osaka University

Racetrack economy introduced by Krugman et al. describes geographical population-movement driven by economic incentive, being regarded as one of the expressions of basic concepts of the New Economic Geography, which explains geographical phenomena such as urbanization by economic theory. The model consists of nonlinear integral equations and a differential equation. In this talk, we first consider formulation of the model into an abstract evolution equation in a proper function space. We then discuss construction of global solutions and asymptotic behavior of them. To explore the asymptotic behavior, we have to rely on not only analytical methods but also numerical ones. Numerical simulations show that global solutions converge to inhomogeneous stationary solutions. Finally, we explore the stability of them. This talk is based on collaborative research with Professor Emeritus Atsushi Yagi of Osaka University.

On a Lotka-Volterra reaction-diffusion-ODE system with the superimposed interaction between two Neolithic populations

Ján Eliaš

University of Graz, Austria

Mathematical modelling plays an increasingly important role in ecology and evolution. Effective models with advanced data analysis improve understanding of the natural world by revealing how the dynamics of species (including human) populations are determined by fundamental biological conditions and processes. The Neolithic transition in Europe involving the change from foraging (hunting and gathering) to agriculture is one of such examples that can be fruitfully modelled mathematically.

Recently we have proposed a reaction-diffusion model that consists of equations that govern the spatio-temporal evolution of sedentary and migrating farmers and hunter-gatherers in the Neolithic transition. Ecologically, the model stems from the fact that a lifestyle of agriculture and settlement, as an evolutionary advantageous trait, can support a much larger population density than hunting and gathering. Therefore, in our modelling framework, we assume that farmers do not migrate unless the population density pressure forces them. The migrating population of farmers as well as hunters and gatherers are assumed to move freely and randomly in this model. Next, we consider the singular limit of the model as a small parameter tends to zero. We obtain another reaction-diffusion model for the spreading of the total population of farmers in Europe, where the spreading is now modelled by a nonlinear porous medium type diffusion equation. From the ecological viewpoint, the nonlinear diffusion takes into account the population density pressure of the farmers on their dispersal.

In this talk, which consists of two lectures, we present

1. modelling of the Neolithic transition in Europe and show the plausibility of the proposed models,

2. well-posedness of the models,

3. singular limit problem as a small parameter tends to zero,

4. asymptotic behaviour of the solutions of the models as time tends to infinity.

This work is done in collaboration with Prof. Danielle Hilhorst (University Paris 11), Prof. Yoshihisa Morita (Ryukoku University), Prof. Masayasu Mimura (Meiji University and Musashino University) and Dr. M. Humayun Kabir (Meiji University).