Partial Differential Equations for Social and Biological Events

Date： October 7-8, 2018

Place： Graduate School of Engineering Science, Osaka University,
Sigma Hall seminar room
(Engineering Science International Bldg. Toyonaka Campus)

MMDS
Center for Mathematical Modeling and Data Science
Osaka University

Partial Differential Equations for Social and Biological Events

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Sigma Hall seminar room

(Engineering Science International Bldg. Toyonaka Campus)

1-3, Machikaneyama, Toyonaka, Osaka, Japan

Access: https://www.osaka-u.ac.jp/en/access/toyonaka/toyonaka.html

Program：

October 7

10:00-10:50   **Clair Poignard** (Inria Bordeaux)

"The potential impact of mathematics in clinical oncology:

the example of electroporation ablation"

10:50-11:40   **Baudouin Denis de Senneville** (Inria Bordeaux)

"On-line guidance of non-invasive therapies in mobile organs"

13:10-14:00   **Inkyung Ahn** (Korea Univ.)

"Non-uniform dispersal on population models under free boundary

in a spatially heterogeneous environment"

14:00-14:50   **Frédéric Marbach** (Renne)

"Obstructions to controllability for PDEs"

15:10-16:00   **Michel Pierre** (Renne)

"Old and new results on global existence in reaction-diffusion systems"

16:00-16:50   **Takashi Suzuki** (Osaka)

"Classical solutions to reaction diffusion systems"

17:30-   **Welcome Dinner**

Poster session: **Noboru Chikami** (Osaka)

Franco Medrano Fermin (Osaka)

Tzirakis Konstantinos (Osaka)

Tatsuki Mori (Osaka)

Yohei Toyota (Osaka)

October 8

10:00-10;50   **Manwai Yuen** (EU Hong Kong)

        "Blowup for the Compressible Euler Equations in R^N "

10:50-11:40   **Philippe Laurençot**   (Toulouse)

        "Global bounded and unbounded solutions to a chemotaxis
         system with indirect signal production"

13:10-14:00   **Kensuke Ohtake** (Osaka)

        "A system of nonlinear integral differential equations in
         economic geography"

14:00-14:50   **Michinori Ishiwata** (Osaka)

        "On the soliton decomposition associated with the energy
         critical heat equation"

Clair Poignard (Inria Bordeaux)

Title :

The potential impact of mathematics in clinical oncology :
the example of electroporation ablation.

Abstract :

Electroporation−based therapies (EPT) consist in applying high
voltage short pulses to cells (typically several hundred volts per
centimeter during about one hundred microseconds) in order to
create defects in the plasma membrane. They provide
interesting alternatives to standard ablative techniques, in
particular for deep seated tumors (located near vital organs or
important vessels). In this talk we present the rationale of
electroporation and its modeling at different scales. We will also
show that combining well suited clinical workflow with
mathematical models can help physicians.

Baudouin Denis de Senneville (Inria Bordeaux)

Title :
On-line guidance of non-invasive therapies in mobile organs

Abstract :

Non-invasive interventional procedures show a high potential in oncology as an alternative to classical surgery. Their objective is to precisely control on-line an energy deposition within a pathological area in order to achieve an effective treatment, with a reduced duration and an increased level of safety for the patient. These new types of non-invasive interventional procedures are very interesting for the treatment of vital organs (such as the kidney, liver and pancreas). However, the treatment of those organs has so far been hampered by the complications arising from their physiological motion. As a consequence, real-time organ motion estimation is rapidly gaining importance for the on-line guidance of such interventional procedures. Modern Magnetic Resonance Imaging (MRI), Cone beam computed tomography (CBCT) or Echography methods now allow a fast acquisition of images with an excellent tissue contrast and high spatial resolution, which opens great perspectives to estimate complex organ deformations. This talk address mathematical issues designed to estimate organ deformations with short latency during the therapy, using real-time image registration techniques applied to anatomical images acquired on-the-fly.

Inkyung Ahn (Korea Univ.)

Title :
Non-uniform dispersal on population models under free
boundary in a spatially heterogeneous environment

Abstract :

In many cases, the movement of species within a region depends
on the availability of food and other resources necessary for its
survival. Starvation driven diffusion (SDD) is a dispersal
strategy that increases the motility of biological organisms in
unfavorable environments i.e., a species moves more frequently
in search of food if resources are insufficient (Cho and Kim, 2013).
In this study, the proposed model represents the dispersion of an
invasive species undergoing SDD, where the free boundary
represents the expanding front. We observe that the spreading-
vanishing dichotomy, which holds in the linear dispersal model
(Zhou and Xiao, 2013), also holds in the model undergoing SDD.
We also provide the estimates for the spreading speed of the free
boundary during the spreading process. Finally, our results are
compared with the results of the linear dispersal model to
investigate the advantages of this strategic dispersal with
respect to survival in new environments.

Frédéric Marbach (Renne)

Title :

Obstructions to controllability for PDEs

Abstract :

Controllability is the question of whether one can act on the state of a system by means of a time−dependent input. For example, for a social or biological system whose evolution is modeled by a PDE, one might wish to drive an initially perturbed state back to an equilibrium.
We will present obstructions to controllability for some very simple non−linear diffusive models, which generalize obstructions which can be encountered on ODE models.

Michel Pierre (Renne)

Title :
Old and new results on global existence in reaction−diffusion systems

Abstract :

We will give a survey on global existence of solutions to reactiondiffusion systems where two main properties hold which often occur in applications, particularly in biochemistry, namely : positivity of solutions is preserved and the total mass of components is controlled for all time. Old and recent results will be described together with open problems.

Takashi Suzuki (Osaka)

Title :

Classical solutions to reaction diffusion systems

Abstract :

We study global−in−time existence of the classical solution to the reaction diffusion system with mass dissipation, where some results on the entropy dissipation system are not available. A small assumption, however, assures it beyond the critical growth of the nonlinearity. Among them is the Lotka−Volterra system in three space dimension.

October 8

Manwai Yuen (EU Hong Kong)

Title :

Blowup for the Compressible Euler Equations in R^N

Abstract :

The compressible Euler equations are fundamental models in the fluid dynamics. In this talk, we present rotational and self-similar solutions for the compressible Euler equations in R^N using the separation method and the Cartesian matrix method for the free boundary problems. Based on the analytical solutions, some blowup phenomena and global existences of the responding solutions can be easily determined. After that, we discuss the new blowup phenomena with the functional energy methods for the solutions of the Euler equations in R^N for the initial value problems.

Philippe Laurençot　(Toulouse)

Title :

Global bounded and unbounded solutions to a chemotaxis system with indirect signal production

Abstract :

Qualitative properties of a chemotaxis model describing the space and time evolution of the densities of two species and the concentration of a chemoattractant are studied. In contrast to the classical Keller–Segel chemotaxis system which involves only one species producing its own chemoattractant, the species which is influenced by the chemoattractant in the model under study is related to another species producing the chemoattractant. As already observed by Tao & Winkler (2017) in a particular case and for radially symmetric solutions, this process has far reaching consequences and shifts finite time blowup to infinite time blowup. The approach in Tao & Winkler (2017) relies on the reduction of the system to a single equation by exploiting both the structure of the equation and the radial symmetry of the solutions, this transformation allowing one to use comparison arguments. We here construct a Liapunov functional and exploit its properties to show the existence of global bounded and unbounded solutions. This construction does not require radial symmetry and extends to other models as well.

Kensuke Ohtake (Osaka)

Title :

A system of nonlinear integral differential equations
in economic geography

Abstract :

In this talk, we consider a mathematical model which describes
geographical population movement driven by economic
incentive. The model was introduced by Krugman et al. in new
economic geography, which explains geographical phenomena
such as urbanization by economic theory.
We begin with explaining economic meanings of the model.
Next, mathematical formulation, global existence and
uniqueness of solutions, and some analytical results for
asymptotic behavior of the solution are presented. Numerical
computation is also carried out to explore details about the
asymptotic behavior of the solution. This talk is based on
collaborative research with Professor Emeritus Atsushi Yagi of
Osaka University.

Michinori Ishiwata (Osaka)

Title :
On the soliton decomposition associated
with the energy critical heat equation

Abstract :

In this talk, we are concerned with the asymptotic behavior of
a semilinear parabolic equation with critical Sobolev exponent.
We give a soliton decomposition type result for time‐global
solution and discuss the asymptotic behavior of time‐global
solution. We also give the asymptotic behavior of finite‐time
blow‐up solutions with bounded energy.
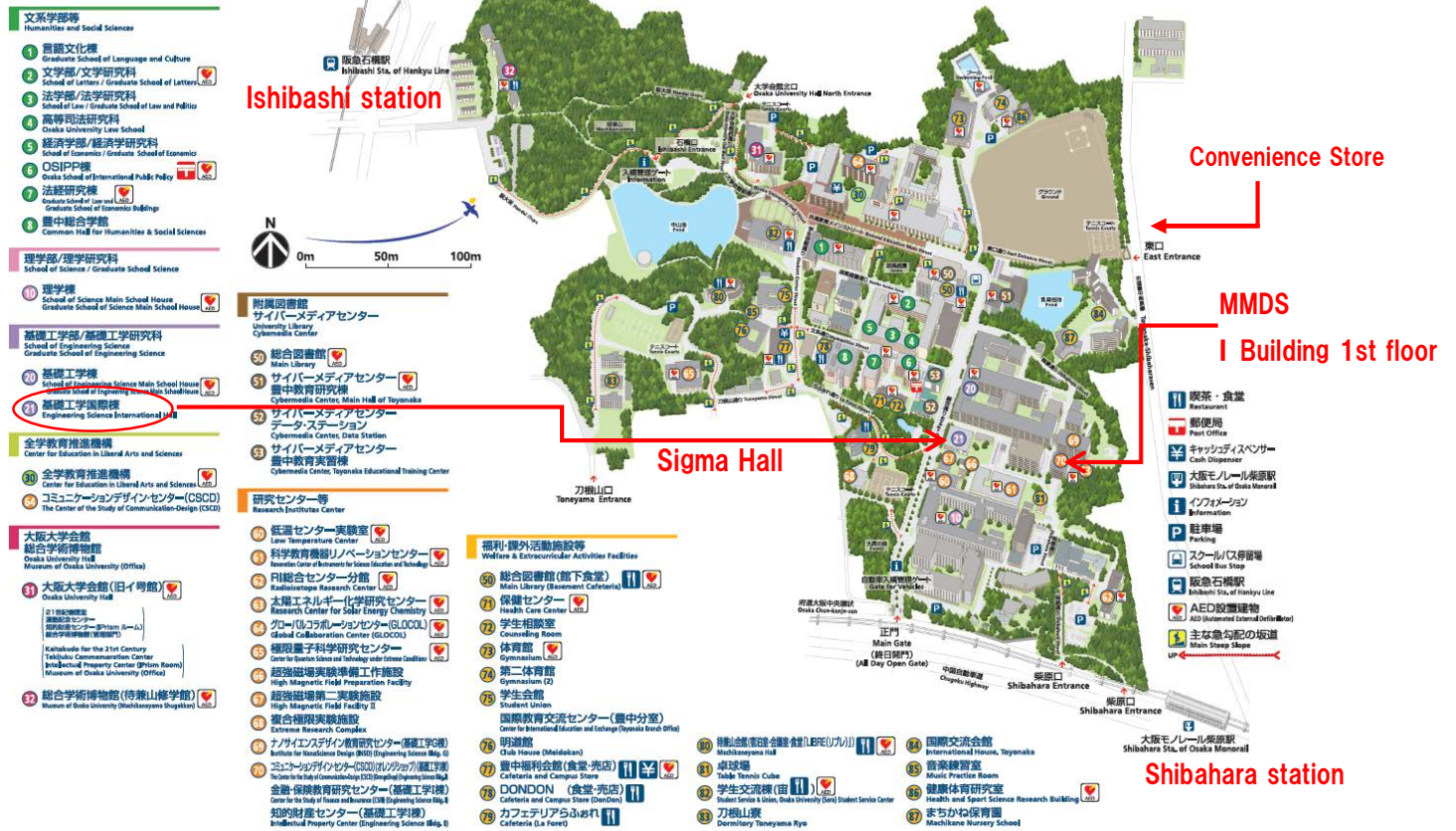
Access Map (Toyonaka Campus)

- **From Osaka Airport (Itami)**

    Monorail to **Shibahara**. (30')

- **From Kansai International Airport** (3 choices)

    (1) *JR line* to **Osaka**, → subway *Midosuji Line*, exit at **Senri-Chuo**, → *Monorail*, exit at **Shibahara**. (2 hr.)

    (2) *Nankai Line* to **Namba**, → *Midosuji Line* subway, exit at **Senri-Chuo**, → *Monorail* to **Shibahara**. (2 hr.)

    (3) *Airport Bus* to **Osaka Airport,** → *Monorail*, exit at **Shibahara**. (2 hr., 30')

- **From Shin-Osaka Station**

    Subway *Midosuji Line (Kita-Osaka Kyuko Line)* to **Senri-Chuo**, → Monorail, exit at **Shibahara**. (1 hr.)
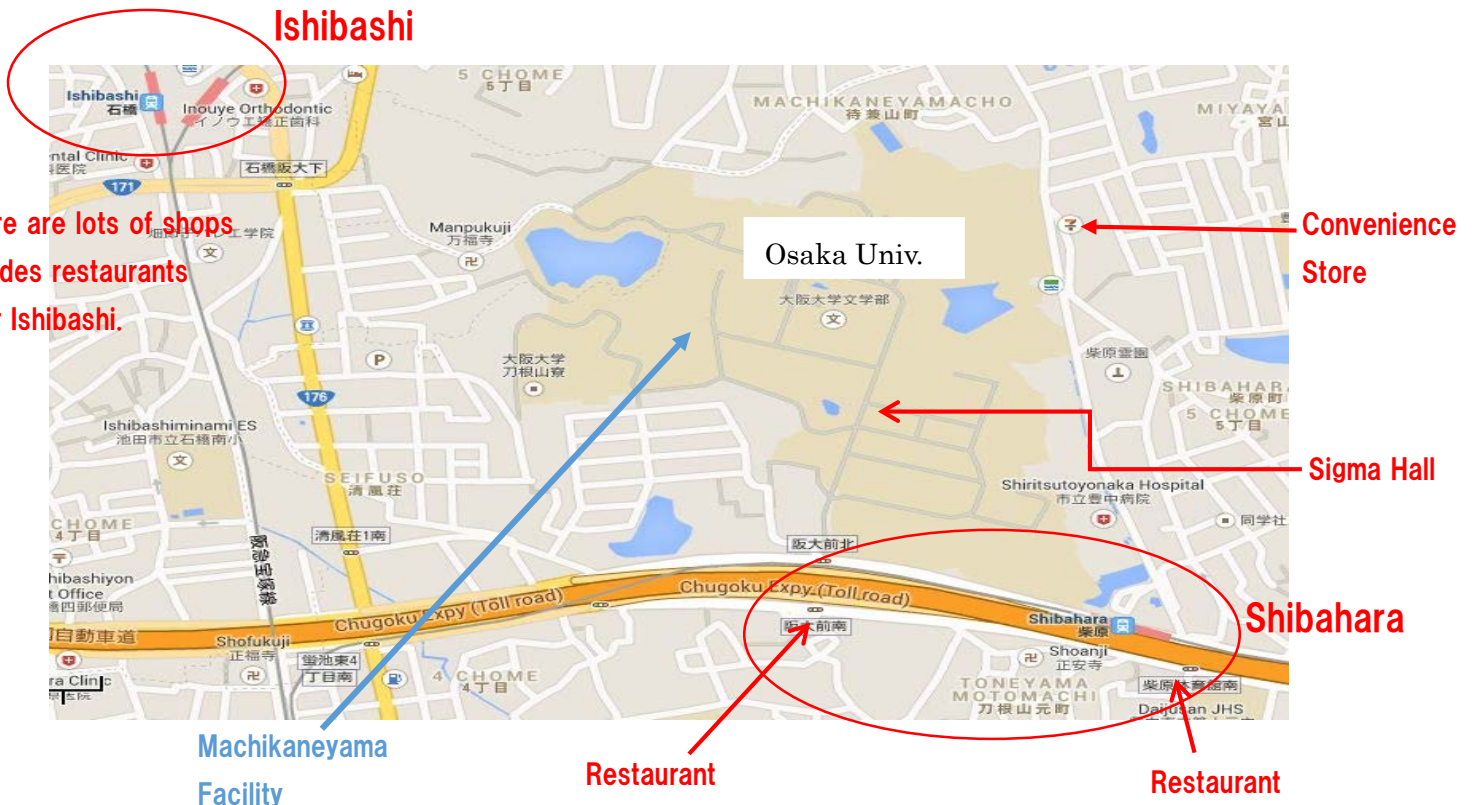
Toyonaka Campus (Sigma Hall)

大阪大学 OSAKA UNIVERSITY　豊中キャンパスマップ　Toyonaka campus map

Ishibashi station

Convenience Store

MMDS
I Building 1st floor

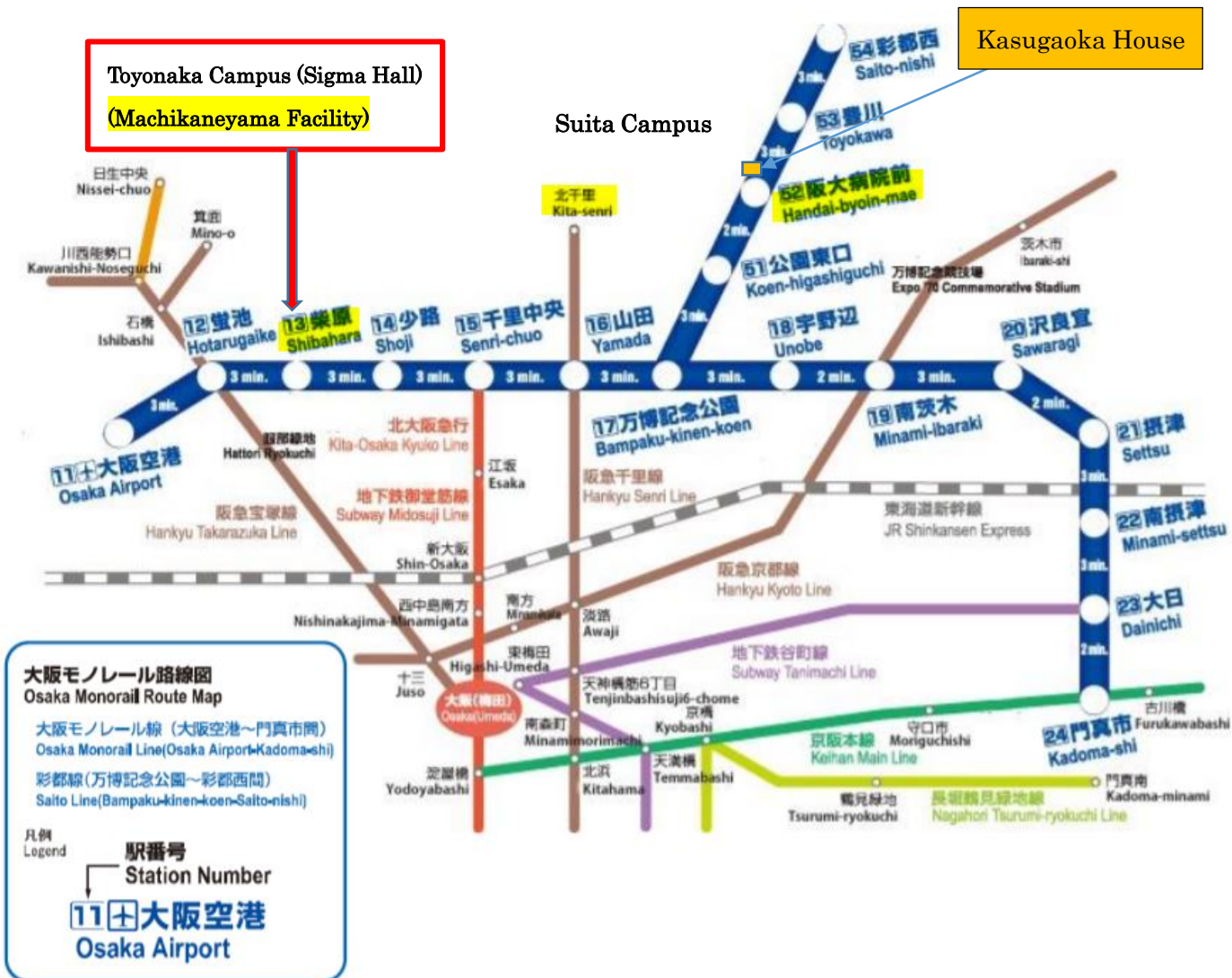**Sigma Hall**

Shibahara station

Restaurants in Toyonaka Campus

| 32: (Sat) 10:30～17:00 | 50: (Sat) 11:00～14:00 |
| 77: (Sat) 11:00～14:00 | 82: (Sat) 8:30～20:00 |

Note! Almost all cafeterias and stores in Toyonaka Campus will be closed on 10/7 and 10/8.

Map around Toyonaka Campus

Ishibashi

There are lots of shops besides restaurants near Ishibashi.

Osaka Univ.

Convenience Store

Sigma Hall

Machikaneyama Facility

Restaurant

Restaurant

Shibahara

Osaka Monorail Route Map (Supplementary information)

Toyonaka Campus (Sigma Hall)
(Machikaneyama Facility)

Suita Campus

Kasugaoka House

Toyonaka Campus ⇆ Suita Campus（¥370）
Monorail **Shibahara** ⇆ Monorail **Bampaku-Kinen-Koen** ⇆ Monorail **Handai Byoin Mae**
(Transfer the Monorail on the opposite side of the same platform)

¥370 (20 minutes)

Links

Osaka University
http://www.osaka-u.ac.jp/en/index.html

Osaka University Access Map
http://www.osaka-u.ac.jp/en/access/

Toyonaka Campus Access Map (Σ Hall)

http://www.es.osaka-u.ac.jp/en/access.html

Suita Campus Map
http://www.osaka-u.ac.jp/en/access/suita

Time table of Bus (Kansai Airport ⇔Itami Airport)

http://www.okkbus.co.jp/en/timetable/kix/t_itm.html

Accommodations
Kasugaoka House (Suita Campus)
http://www.osaka-u.ac.jp/en/academics/facilities/BandB/kasugaoka_house

Machikaneyama Facility (Toyonaka Campus)
http://www.osaka-u.ac.jp/en/academics/facilities/BandB/staff_facility/machikane_facility

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