TCMB 2026 Workshop on Applicable Analysis

June 26, 2026

3F Conference Room, Math. Building, National Cheng Kung University

Invited Speakers:

Shin-Ichiro Ei, Josai University, Japan
Hideo Ikeda, University of Toyama, Japan
Hiroshi Ishii, Hokkaido University, Japan
Ken-Ichi Nakamura, Meiji University, Japan
Toshiko Ogiwara, Josai University, Japan
Izumi Takagi, Tohoku University, Japan

Program:

10:30-11:00 Takagi
11:00-11:30 Ogiwara
11:30-12:00 Ei

12:10-13:30 Lunch

13:30-14:00 Ishii
14:00-14:30 Nakamura
14:30-15:00 Ikeda

15:00-17:00 Free Discussions

Organizers:
Jong-Shenq Guo (TKU), Matthew M. Lin (NCKU), Kung-Chien Wu (NCKU)

Sponsored by
National Cheng Kung University
National Science and Technology Council, Taiwan
Tamkang Center for Mathematical Biology, Tamkang University

Titles and Abstracts

Izumi Takagi

Title: Traveling front solutions of a reaction-diffusion-ODE system with hysteresis

Abstract:
We consider a system of one reaction-diffusion equation coupled with three ordinary differential equations which models pattern formation in developmental biology. The model forms a slow-fast system with three time-scales. We shall construct traveling front/back solutions by applying Fenichel's theorem on normally hyperbolic manifolds and blow-up analysis around fold points.
This is a joint work with Lingling Hou.

Toshiko Ogiwara

Title: On the equilibrium solutions for bistable reaction–diffusion equations on a star-shaped metric graph

Abstract:
This talk concerns a bistable reaction–diffusion equation with McKean-type nonlinearity on a bounded or unbounded star-shaped metric graph. Among other things, we study the existence and nonexistence, as well as the multiplicity, of equilibrium solutions with monotone profiles. We also investigate how the structure of the set of such equilibrium solutions changes depending on whether the graph is bounded or unbounded.

Shin-Ichiro Ei

Title: Motion of front solutions for shadow systems

Abstract:
We consider shadow systems of activator–inhibitor type. Using the front interaction method, I show the existence of a subcritical Hopf bifurcation of front layers with respect to the time coefficient. A comparison with the exact solution is also discussed.

Hiroshi Ishii

Title: Reaction-diffusion approximation of nonlocal interactions in high-dimensional space

Abstract:
This talk focuses on the relationship between convolution-type nonlocal interactions and multi-component reaction-diffusion systems in arbitrary spatial dimensions. We show that nonlocal interaction terms in evolution equations can be approximated by solutions of suitably constructed systems of diffusive substances. The key observation is that any integrable radial kernel can be approximated by a linear combination of Green's functions of elliptic partial differential equations. This approximation allows a finite number of auxiliary diffusive components to reproduce a wide class of nonlocal interactions.

Ken-Ichi Nakamura

Title: A remark on linear/nonlinear determinacy of minimal wave speed for monostable reaction-diffusion equations

Abstract:
The KPP condition is a well-known criterion for linear determinacy regarding the minimum traveling wave speed in scalar monostable reaction-diffusion equations. Weinberger extended this criterion in 2012, leading to further research exploring the threshold between linear and nonlinear determinacy. However, because his approach relies on phase plane analysis, it is difficult to apply to multicomponent systems. In this talk, we propose an approach that utilizes the comparison principle to analyze the linear/nonlinear determinacy in such scalar equations, with a view to its application to multicomponent systems.

Hideo Ikeda

Title: Stability of multi-layered solutions in some mass-conserving reaction-diffusion shadow systems

Abstract:
We investigate the stability of steady-state solutions with an internal transition layer in a two-component reaction-diffusion system with a conserved quantity. This model equation describes a situation in which cellular polarity is formed. While steady-state solutions with a single transition layer are stable, are steady-state solutions with multiple transition layers also stable? For the linearized eigenvalue problem, the critical eigenvalues are very small, and their signs has not yet been determined. Here, for the shadow system, we show that the linearized eigenvalue problem for steady-state solutions with n transition layers has n critical eigenvalues, of which n-1 are extremely small and have positive signs. This research is based in part on a collaboration with Masataka Kuwamura.