Kanazawa University -
University of the the Philippines Baguio

Joint Seminar in Mathematics

February 8, 2022, via Zoom

Opening 13:50 - 14:00 JST / 12:50 - 13:00 PST
Session 1. *14:00 - 15:00 JST / 13:00 - 14:00 PST* *(Moderator: Julius Fergy Rabago)*

S. = Schedule · **T.** = Title · **A.** = Abstract

1. **Nialle Loui Mar "NLM" T. Alcantara**[†,‡], Rizavel C. Addawe[†], and Joel M. Addawe[†]
   [†]*University of the Philippines Baguio*
   [‡]*Don Mariano Marcos Memorial State University - South La Union Campus*

   S. 14:00 - 14:15 JST / 13:00 - 13:15 PST

   T. A particle swarm optimization algorithm using Gamma distribution function

   A. The Particle Swarm Optimization (PSO) is a swarm intelligence-based, population- based meta-heuristic optimization algorithm. In this study, a variant of PSO is introduced by using the standard gamma distribution function in each particle's movement. The mathematical model $S = (S_t)_{t\in\mathbb{N}_0} = ((X_t, V_t, L_t, G_t))_{t\in\mathbb{N}_0} = ((X_0, V_0, L_0, G_0), (X_1, V_1, L_1, G_1), \ldots)$, where S is the swarm, N the number of particles, and X_t, V_t, L_t, and G_t the properties of each particle of the gamma-based swarm was presented and analysed. Numerical simulations were performed on five (5) test functions to validate the analytical results. Furthermore, numerical experiments were conducted to compare performance of the proposed algorithm with the standard PSO.

2. **Janus Capellan Aban**, *National Taiwan Normal University*

   S. 14:15 - 14:30 JST / 13:15 - 13:30 PST

   T. Neutrino fields in extended Minkowski space

   A. In this presentation, I will talk about Kaluza-Klein neutrinos propagating in $[1+(3+\delta)]$-dimensional Minkowski space. The Standard Model (SM) neutrinos are confined in the 3-brane or 4D-spacetime. The fields describing the SM and KK neutrinos intersected at a fixed point in the brane. This interaction of the two fields might explain the tiny mass generations of the SM neutrinos through effective Lagrangian which involves Yukawa terms. Finally, the unitary matrix used to diagonalize the Hermitian mass matrix is used to determine the neutrino oscillations.

3. **Renz Jimwel S. Mina**, *University of the Philippines Baguio*

   S. 14:30 - 14:45 JST / 13:30 - 13:45 PST

   T. Introduction to elliptic curves and the congruent number problem and its variants

   A. The goal of this presentation is to discuss an overview of the arithmetic of elliptic curves which includes the addition law on points of an elliptic curve, the group structure of these points, and the computation of the torsion subgroup and rank of an elliptic curve. Moreover, we present a related problem in Number Theory called the congruent number problem, and discuss some of its extensions and their relation to elliptic curves.

4. **Eduard Taganap**, *Central Luzon State University*

   S. 14:45 - 15:00 JST / 13:45 - 14:00 PST

   T. k-isocoronal tilings

   A. In this talk, a framework is presented that allows the systematic derivation of planar edge-to-edge k-isocoronal tilings from tile-s-transitive tilings, $s \leqslant k$. A tiling $\mathscr{T}$ is -isocoronal if its vertex coronae form k orbits or k transitivity classes under the action of its symmetry group. The vertex corona of a vertex of $\mathscr{T}$ is used to refer to the tiles that are incident to x. The k-isocoronal tilings include the vertex-k-transitive tilings (k-isogonal) and k-uniform tilings. In a vertex-k-transitive tiling, the vertices form k transitivity classes under its symmetry group. If this tiling consists of regular polygons then it is k-uniform.

Session 2. *15:10 - 16:10 JST / 14:10 - 15:10 PST* *(Moderator: Hirofumi Notsu)*

S. = Schedule · **T.** = Title · **A.** = Abstract

1. **John Sebastian Simon**, *Kanazawa University*

   S. 15:10 - 15:25 JST / 14:10 - 14:25 PST

   T. TBA

   A. TBA

2. **Md. Mamunur Rasid**, *Kanazawa University*

   S. 15:25 - 15:40 JST / 14:25 - 13:15 PST

   T. A Lagrange-Galerkin scheme of second-order in time for the shallow water equations with a transmission boundary condition

   A. This study presents a Lagrange-Galerkin (LG) scheme of second-order in time for the shallow water equations (SWEs) with a transmission boundary condition. Firstly, we confirm the experimental order of convergence of the scheme. Secondly, we apply the scheme to a practical case, i.e., a complex geometric domain with a transmission boundary condition. Finally, based on the numerical experiments, we summarize the advantages of our scheme, second-order accuracy in time, mass conservation, and no significant reflection from the transmission boundary.

3. **Yuki Suzuki**, *Kanazawa University*

   S. 15:40 - 15:55 JST / 14:10 - 14:55 PST

   T. Numerical study of a volume constrained shape optimization problem

   A. Shape optimization problems often arise primarily in the engineering research field. This talk considers the Poisson equation and the stationary convection-diffusion equation for the state variable and finds a domain shape that minimizes an objective function under an area-preserving constraint. First, we set a Stokes-type problem to determine the velocity field having the area-preserving property to perturb the domain. Then, after showing a non-increasing property of the objective function, we present numerical results in two-dimensional space.

4. **Takahiro Fujita**, *Kanazawa University*

   S. 15:55 - 16:10 JST / 14:55 - 15:10 PST

   T. Numerical examples of the sparse modeling

   A. Sparse modeling is an important idea in the research fields of image processing, signal processing, and machine learning and has the advantage of obtaining an approximate function from a small amount of given data. In other words, it enables us to find the sparsest possible essential basis functions for modeling a data set if it is assumed to have a sparse representation. In this talk, we compare the sparse modeling with other methods, including L_2-type methods, in numerical examples to study the properties of sparse modeling, where a keyword is L_1-norm.

Session 3. *16:20 - 17:20 JST / 15:20 - 16:20 PST* *(Moderator: Jerico Bacani)*

S. = Schedule · **T.** = Title · **A.** = Abstract

1. **Gervy Marie Angeles** and Christian Schmeiser, *Universität Wien*

   S. 16:20 - 16:35 JST / 15:20 - 15:35 PST

   T. Short filament approximation for lamellipodium dynamics

   A. In contact with flat adhesive substrates, most biological cells form a thin membrane protrusion called the *lamellipodium*. The lamellipodium, with actin filaments as major components, is an important organelle responsible for the *crawling motion* of cells. To understand this phenomenon, the so-called *Filament Based Lamellipodium Model* was developed in a series of works, see e.g. [Manhart, A. and Ölz, D. and Schmeiser, C. and Sfakianakis, N., *An extended Filament Based Lamellipodium Model produces various moving cell shapes in the presence of chemotactic signals*, Journal of theoretical biology, **382** (2015) 244–258]. It is a two-dimensional continuum model derived from several mechanical and biochemical effects such as cell-to-substrate adhesion, filament bending, cross-link dynamics, and filament-to-filament interactions. In contrast to the previous works, we incorporate the assumption of short, and consequently, rigid filaments. This allows us to obtain a mathematically simpler and computationally less expensive model.

2. **Paul Samuel Ignacio**, *University of the Philippines Baguio*

   S. 16:35 - 16:50 JST / 15:35 - 15:50 PST

   T. Research initiatives in Topological Data Analysis

   A. TBA

3. **Reymart Lagunero**[†], Klemens Fellner[†], and Thomas Apel[‡]
   [†]*Karl-Franzens-Universität Graz*
   [‡]*Universität der Bundeswehr München*

   S. 16:50 - 17:05 JST / 15:50 - 16:05 PST

   T. Numerical simulation of a reaction-diffusion model for lipid hydrolysis

   A. In this talk, we present a reaction-diffusion model describing the evolution of substrate concentrations in lipid hydrolysis, a three-step coordinated process of triglyceride degration. We use the Michaelis-Menten equation to model the reactions, which then leads to a nonlinear evolution problem. We focus on the stationary state model and compute for explicit radially-symmetric solutions. Finally, we use a finite element method to approximate the solutions.

4. **Julius Fergy Rabago**, *Kanazawa University*

   S. 17:05 - 17:20 JST / 16:05 - 16:20 PST

   T. Numerical methods for the Bernoulli free boundary problem and related topics

   A. I will discuss numerical shape optimization techniques for solving the Bernoulli free boundary problem based on FEM. Related approaches to solving shape identification and moving boundary problems with numerical examples are also presented.

Closing 17:20 - 17:30 JST / 16:20 - 16:30 PST