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From Japan

A Method for Spherical Laguerre Voronoi Diagram Approximation of a Spherical Tessellation

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Abstract

We propose a method for approximating spherical tessellations whose edges are parts of geodesic arcs with spherical Laguerre Voronoi diagrams. Since there are many real world objects displaying as spherical tessellations such as fruit skin patterns, the approximation of those patterns with the spherical Laguerre Voronoi diagrams will be useful for constructing mathematical models of the patterns formation. In this study, we firstly construct a spherical Laguerre Voronoi diagram with respect to the given tessellation. The approximation method is employed by adjusting the polyhedron corresponding to the spherical Laguerre Voronoi diagram, in which the problem is reduced to the optimization problem.

Two-dimensional traveling waves in a three-species competition-diffusion system

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Abstract

Three-species competition-diffusion systems may admit two different planarly stable traveling wave solutions. The study of the interaction of these waves in one dimension has been shown to offer insight about whether or not coexistence occurs in two-dimensional domains. However, when planar fronts collide at a certain angle, phenomena which are not immediately reducible to the one-dimensional case can be observed. Such interactions produce different types of moving patterns which seem to tend to truly two-dimensional traveling waves, such as wedge-shaped waves.

On the existence of limit cycles for Liénard-type equation with bounded nonlinearities and φ-Laplacian

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Abstract

We consider the second-order nonlinear differential equation of Liénard type $(\varphi(\dot{x}))^{\cdot} + f(x)\varphi(\dot{x}) + g(x) = 0$. Here, $^{\cdot} = d/dt$, the functions φ, f, and g are smooth, and $g(x)$ satisfies the signum condition $xg(x) > 0$ if $x \neq 0$. When the range of φ is bounded, the equation does not always have global solutions. In fact, if $\varphi(x) = x/\sqrt{1+x^2}$, $f(x) = x^2 - 1$, and $g(x) = x$, then the equation does not have any global solutions and limit cycles. The purpose of this study is to obtain a sufficient condition for the existence and nonexistence of limit cycles for the equation.

Statistical analysis of music rendering features toward jam session systems

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Abstract

A jam session system is an automatic accompaniment system which each player can interplay with all other players. The session like jazz mainly consists of improvisation so that a player needs to estimate the performance according to interpret other player's intention rather than using of score information. To track the player's intention, we propose a method for estimating the performance by learning the transition of features from the MIDI data. In this study, we suppose that the performance is expressed in discrete transition because of multiple states, we have initially extracted the features and estimated the clusters of a bar unit and a beat unit by following 3 methods; (1) k-means, (2) GMM, (3) NMF, additionally compared and evaluated the predictability of their methods for following 3 models by tri-gram; (i) the transition model for bar clusters, (ii) the transition model for beat clusters, (iii) the mixed transition model. The experimental results show that the method by NMF is the highest degree of accuracy for estimated performance.

Simple Elastic Network Models for Exhaustive Analysis of Long Double-Stranded DNA Dynamics with Sequence Geometry Dependence

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Abstract

Simple elastic network models of DNA were developed to reveal the structure-dynamics relationships for several nucleotide sequences. First, we propose a simple all-atom elastic network model of DNA that can explain the profiles of temperature factors for several crystal structures of DNA. Second, we propose a coarse-grained elastic network model of DNA, where each nucleotide is described only by one node. This model could effectively reproduce the detailed dynamics obtained with the all-atom elastic network model according to the sequence-dependent geometry. Through normal-mode analysis for the coarse-grained elastic network model, we exhaustively analyzed the dynamic features of a large number of long DNA sequences, approximately 150 bp in length. These analyses revealed positive correlations between the nucleosome-forming abilities and the inter-strand fluctuation strength of double-stranded DNA for several DNA sequences.

Mathematical Modeling of Vegetation and Desertification

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Abstract

Desertification is one of the serious threats to the ecosystems. For the occurrence of desertification, in 1999, Klausmeier proposed a simple two component reaction-diffusion model which describes the interaction of water and plant. In spite that this is a simple model, it exhibits spatial vegetation patterns which is in reasonable agreement with field observations of regular and irregular vegetation patterns. Since then, several models have been proposed from the view of modeling of vegetation and desertification which could facilitate the understanding of dynamics of water and plant. In this talk, by introducing them from modeling point of views, I would like to explain the reason why Klausmeier model is a good minimal model of vegetation and desertification.

Quantifying the duration and the distribution of the eclipse phase for *in vitro* infection with SHIV-KS661

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Abstract

The time between viral entry and the start of viral protein production is defined as eclipse phase. The duration of the eclipse phase varies with each viral strain and plays a important role in viral dynamics. The most basic mathematical model extensively used for many kinds of virus strain assumed that the infected cells produce viral particles instantly after they are infected [1]. This assumption is appropreate when the duration of the eclipse phase is negligible on the time scale of infection. However, when the duration of eclipse phase is not negligible, it might have an influence on a mathematical model with regard to paratmeter estimation and model prediction. In this study, we investigated the duration and the distribution of a highly pathogenic simian/human immunodeficiency virus strain in vitro using both mathematical model and experimental measurement. We found that the eclipse phase last approximately 24 hours and is consistent with Erlang distribution [2].

References

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Development of constant exchange probability method in multi-dimensional replica exchange Monte Carlo

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Abstract

We propose a new technique with multi-dimensional replica exchange Monte Carlo (REM). Multi-dimensional REM is a way to sample from a system with multiple interactions. For this method, however, practical ways to optimize coupling constant sets have not been studied so far. Therefore, we develop constant probability method of multi-dimensional REM for improving probability of replica exchange. Thus, we extend Hukushima's iterative scheme for REM as a way to determine coupling constants for multi-dimensional REM. Our proposed method optimizes the simulated coupling constant sets to realize constant probability of replica exchange.

On the convexity and existence of traveling wave solutions of mean curvature flows

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Abstract

Mean curvature flow (MCF) is a geometric flow of hypersurfaces. In 2, 3-dimensional Euclidean spaces, MCF is naturally appeared as a mathematical model of various physical and biological phenomena, e.g., soap films, grain boundaries, ray optics and population dynamics.

In this talk, we consider the existence and non-existence of traveling wave solutions, for generalized MCF, which is a Jordan curve in 2-dimensional space. When there exist traveling wave solutions, we intend to make reference to the shape of traveling wave too. Finally, we introduce the application to a free boundary problem describing cell locomotion by using this result.

All global bifurcation curves for a cell polarization model

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Abstract

We have investigated a stationary limiting problem for a cell polarization model proposed by Y. Mori, A. Jilkine and L. Edelstein-Keshet (SIAM J.Appl Math, 2011). We give answers to the existence, nonexistence, direction, connection of all global bifurcation curves including the unique existence of the secondary bifurcation point. We also clarify all limiting profiles of solutions as a diffusion coefficient tends to 0.

An analytical framework for studying small-number effects in catalytic reaction networks

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Abstract

In living cells, there are enormous reactions by many molecular species, that constitutes huge and complex reaction networks. Particularly, catalytic reactions by such as enzymes are considered to play an important role in those reaction networks. Recent years, it has been pointed out that if the number of molecules participating catalytic reaction networks is small, those behave in a qualitatively different way from that in the case of huge numbers. The quantitative evaluation for small-number effects in such systems should be carried by using chemical master equations considering discrete and probabilistic aspects of reactions between molecules. However, it is generally difficult to obtain its explicit solutions, and hence most efforts have been devoted to the development of approximation and simulation methods and their applications. In such a situation, we aimed to develop a theoretical framework for analyzing the chemical master equations to deeply understand such small-number effects.

To discuss a wide class of catalytic reaction networks, we consider an abstract catalytic reaction network consisting of two-body catalytic reactions. The corresponding chemical master equation is analyzed by the probability generating function method. In the results, under a certain condition (*entire ergodicity*), we successfully obtain several analytical formulae predicting the time-averaged concentration and its variance etc of each species. We will also present simple several applications such as a rank conservation law with respect to the time-averaged concentration of each species.

Comparison of Two Control Architectures for Feedback-Error Learning

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Abstract

Feedback Error learning (FEL) based controllers are one of the most used control architectures in modern devices, mainly because its good performance with high frequency reference signals. However this FEL control depends on the architecture and features of its Artificial Neural Network. Despite that they have been many attempts to create a general procedure for FEL controller design, a proper solution still under research. In this paper a comparison between a classic FEL architecture and a novel solution is proposed to solve a trajectory following problem.

Why can an oil droplet turn over even without boundary?

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Introduction

Development of self-propulsion has been investigated for understanding the mechanism of biological motion in living organisms. Self-propelled droplets, which indicate characteristic features of motion, have been well investigated as an inanimate system. We investigated self-motion of a butyl salicylate (BS) droplet on a sodium dodecyl sulfate (SDS) aqueous solution in a linear channel. Mode of BS droplet motion was bifurcated between no motion, reciprocation with a small amplitude, and reciprocation with a large amplitude, depending on the concentration of SDS.

Experiment

The BS droplet (volume: 10μL) was gently placed on a SDS aqueous solution (volume: 40mL) which was poured into a rectangular glass vessel (300mm (length)×15mm (width)×10mm (height)) to restrict motion one-dimensionally. We measured the interfacial tension of SDS and BS molecules at air/water and oil/water interfaces, dissolution of BS in the aqueous solution, and contact angle.

Results

With an increase in $C_{\mathrm{SDS-w}}$, self-motion of a BS droplet as the oil droplet was bifurcated, i.e. no motion ($C_{\mathrm{SDS-w}}$ $\leq$ 10mM), reciprocation with a small amplitude (10$< C_{\mathrm{SDS-w}} \leq$30mM), reciprocation with a large amplitude ($C_{\mathrm{SDS-w}}$ >30mM) of which size was close to the half lengths of the chamber.

Discussion

We suggested the mechanism for the reciprocation with a small amplitude without boundary. The BS droplet accelerates due to the difference in $C_{\mathrm{SDS-w}}$ around the droplet. Next, the droplet is decelerated by the resistive force from the water phase and the adsorption of SDS on the BS droplet. The BS droplet does not stop but reverts. This means that we should consider the reverse force. In general, the driving force of motion is considered based on the surface tension vs. concentration of the source of the driving force, i.e., the mixture of SDS and BS. The surface tension of the mixture of SDS and BS decreases with an increase in the concentration of SDS. Such a gradient (dγ / dc) becomes the driving force. The droplet moves to the higher surface tension, that is, the acceleration direction for (dγ/dc)$>$ 0 is opposite to that for (dγ/dc), so the existence of local minimum for $\gamma - C_{\mathrm{SDS-w}}$ plays an important in the reverse motion.

References

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A comparison between Vicsek model and Matuda model

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Abstract

Each animal perceives only neighborhoods to plan what to do by itself. Nevertheless, the swarm moves like a single animal when animals swarm. This problem how the swarm is maintained without the leader is researched in various research areas. In this presentation, I will compare Vicsek model and Matuda model, typical mathematical models of swarms, and consider how the elements of each model influence swarm formation.

The rule of direction averaging causes a maintained swarm in Vicsek model. Direction averaging is the rule that direction of a particle is average direction of neighborhoods. Additionally, the particles move at constant speed in Vicsek model. On the other hand, Matuda model, a model of fish school, has a different way to average direction. A fish has the acceleration, which directs to a vector of average velocity of neighborhoods. Thus, the speed of the fish changes in Matuda model as opposite to Vicsek model. In addition, fish have a terminal velocity because fish swimming in water receive the fluid resistance.

As above, these two models have the difference. I consider the most important difference whether the speed of the particles changes or not. In this presentation, I will report how the difference influences swarm formation at last.

Splash Process Due to Grain Impact on Granular Bed

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Abstract

Massive sediment transport phenomena, such as drifting snow and dust storm, pose a considerable threat to human life. Further, the formation of geomorphological patterns on sand-desert and snowfield surfaces as a result of sediment transport, such as dunes and ripples, is of considerable research interest. To elucidate the granular transport that occurs near the surface of snow and sand fields, it is necessary to focus on the collisions between wind-blown grans and these surfaces along with the resultant ejection of grains from the surfaces. This approach is merited because, in the case of wind-blown grain transport, the major component of the grain entrainment into the air is caused by both the collision and ejection. This mechanism is called the "splash process". However, because of complexity of jumping grains over the ground surface, detailed measurement is very hard. Therefore in order to investigate the splash processes, we perform numerical simulation which simulates detailed process of splash caused by 1-grain collision. For numerical simulation, we use discrete element method (DEM) which models the motion of discrete grains.

As a result, we obtained good correspondence between our numerical results and the findings of previous experiments. Moreover, we found that the motion of ejection grains (angles and speed) depends on the ejection timing.

What determine the plane of first cleavage in sea urchin embryo?

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Abstract

In sea urchin, *Strongylocentrotus purpuratus*,the future oral-aboral axis lies 45 degree clockwise from the first cleavage plane as viewd from the animal pole (Cameron et al., 1989). However, the mechanism of the determination of the first cleavage plane has not been clarified yet. On the other hand, the mechanism of the determination of first cleavage plane has been investigated in vertebrate. In mouse embryo, orientation of the first cleavage is associated with the site of the previous meiosis (Gardner et al., 1997; Plusa et al., 2002). Furthermore, sperm entry might provide a second cue (Piotrowska and Zemicka-Goetz, 2001; Plusa, et al., 2002).

In this study, in order to investigate that the entrance of sperm is involved in the determination of the first cleavage plane of sea urchin embryo, we carried out time-lapse imaging analysis to follow the sea urchin development from fertilization.

Pattern formation caused by non-local interaction

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Abstract

Recently, various non-local interactions arise in many fields. In particular, the non-local interaction with short range activation and long range inhibition effect has been reported in the neural firing phenomenon in brain and the pigment cells in the skin of the zebrafish. The non-local evolution equation for these pattern formations is characterized by the convolution of the suitable kernels. We found that the desta- bilization of the solution is very sensitive for the shape of the kernel. To specify the relationship between the destabilization and the kernel shape, we analyze the non-local evolution equation. Approximating it by a reaction diffusion system, we will reveal the relationship between the destabilization caused by the non-local interaction and the Turing instability of the reaction diffusion system.

Max-Min-Plus expressions of multi valued particle cellular automata

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Abstract

In this study, we investigate one dimensional particle cellular automata (Particle CA) with three states and three neighbors. We derive evolution equations for 15 Particle CA using the max-min-plus expressions in Euler description. We transform Euler description of 15 Particle CA into Lagrange description using a Cole-Hopf transformation and the step function.

Origami-performing robot: case of modeling and simulation

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Abstract

Origami is a tradional Japanese craft that is based on the folding of the designed structure and can be widely used by industry. Origami folding is not a difficult task for human hand, however, folding by a robot hand is such a challenge. In this presentation, we suggest a novel approach for designing the origami-performing robotic systems. The main idea of the proposed method is to simulate the origami folding by the robot arms. The results of the simulation are the basis for making the final robot design. Moreover, problems of the numerical simulation, including paper material structure, designing simulation origami model, the distribution of the applying forces and others are considered carefully. The design of robotic system based on the simulation of forming creases for the origami model shows that the proposed method can be applied to build the origami-performing robotic systems.

Concentration points in stationary solutions of a heterogeneous reaction-diffusion equation

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Abstract

We are interested in a point-condensation phenomenon in stationary solutions of a spatially heterogeneous reaction-diffusion equation. The equation plays an important role in the study of a mathematical model for biological pattern formation. Under homogeneous Neumann boundary conditions, the equation has a family of steady-state solutions which concentrate around finitely many points when the diffusion coefficients is sufficiently small, and such solutions are called *spiky solutions*. In order to know where spikes are formed, we introduce a *locator function* composed only of the coefficients in the equation and prove that any concentration point must be a critical point of the locator function. Moreover, we construct a solution concentrating near a nondegenerate critical point of the locator function.

Shape optimization of reversed spiral cylindrical origami structure for safety helmet

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Abstract

The exiting safety helmet has some disadvantages: they are expensive, they take up space, and inconvenient to carry. Therefore, it is necessary to design of a new folding helmet including the RSC folded structure with plastic material for satisfying the same safety performance.The mechanical characteristics of the RSC folded structure for safety helmet model was investigated.Response Surface Method (RSM) is used to optimize the shape of the RSC folded structure. The explicit FEM software LS-DYNA is used to solve impact analysis. The results show that the RSC folded structure plays a significant role in decreasing the collision force when impact happened.

From Taiwan

Randomized Singular Value Decomposition

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Abstract

Singular value decomposition (SVD) of a matrix is important in many topics. However, the costs for computing SVD of a matrix by traditional methods are expensive, especially when the matrix is large. A strategy for computing low-rank SVD for large-scale matrices is using randomized algorithm to reduce the computational dimension and thus the computational cost. In this talk, randomized SVD algorithms will be discussed and some numerical experiments on the applications in genomes data will be presented.

Asymptotic properties of stationary Navier-Stokes flows in the setting of two dimension hyperbolic spaces

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Abstract

In this talk, I will present a piece of unpublished recent joint work with Professors Chi-Hin Chan and Magdalena Czubak. In this work, we study asymptotic properties of stationary Navier-Stokes flows on the exterior domain on hyperbolic plane. During the talk, I first mention some classical results of stationary Navier-Stokes flows passing an obstacle in the 2D-Euclidean setting. Then, I present our work which addresses the far range decay of the velocity and vorticity of the stationary Navier-Stokes flow in the hyperbolic setting.

Some interesting behavior of Chan-Vese model for image segmentation

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Abstract

Image segmentation is a classical issue in computer vision and the state-of-the-art methods include thresholding, clustering, graph cuts, matrix decomposition based methods and partial differential equation based methods. Chan-Vese model[1] which belongs to partial differential equation approaches has been widely used in image segmentation tasks. The method optimally fits a two-phase piecewise constant model to the given image and the segmentation boundary is represented implicitly with a level set function. This talk describes the level set formulation of the Chan-Vese model and discusses the potential applications.

References

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A determinist/stochastic epidemiological population models

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Abstract

In this talk, first we review the new results of Kun. and Carlos. on a simple epidemiological model for populations in the wild with Allee effects and disease-modified fitness. Secondly, we study the stochastic dynamics of solutions for this model. Specially, if the step size of Brownian motion is small enough, then the solutions converge to the equilibrium points. In the future, we will investigate the possible property of Wiener process about this model.

CHiS: Compressed Hierarchical Schur Method for Finite-Difference Frequency Domain Analysis of Photonic Devices

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Abstract

Double-curl vector Helmholtz equation is one of the governing equation of wave optics and photonic device analysis. The equation can be discretized by Yee's mesh, which is a variation of finite-difference method with staggered grid and a fundamental scheme in popular finite-difference time-domain (FDTD) method. The generated linear system can be ill-conditioned when computation domain is large or absorptive boundary conditions are used. Direct factorization is a robust approach to solve the ill-conditioned linear system, though the computation cost can be huge for 3D problems. Therefore, we propose the compressed hierarchical Schur method (CHiS) to reduce the computation cost. The concept of CHiS is to identify redundancy in linear system based on physical problem, discretization, and relations among Schur hierarchy. Computation cost can be greatly reduced when the redundant blocks are replaced by ghost blocks. From numerical results, the CHiS method takes 45% less factorization time and 35% less memory usage compared with the uncompressed hierarchical Schur method in selected test. The CHiS method is also highly efficient in multicore computing systems, and results show many computing operations is close to performance peak of the processors. It also demonstrates the potential of the CHiS method in modern high-performance computing environments.

References

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LOCAL ILLPOSEDNESS OF THE ONE DIMENSION ZAKHAROV SYSTEM

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Abstract

In 2007, Justin Holmer did the ill-posedness of the one dimension Zakharov system in the inhomogeneous Sobolev space. When I researched his paper, I found some interesting stuff that I can obtain the bigger ill-posedness area than his result by improve his calculation and give the different data choice of the result from Ginibre-Tsutsumi-Velo's paper. In this talk, I will show you how to do.

References

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Global Transonic Solutions of Planetary Atmospheric Escape Model in Hydrodynamic Region

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Abstract

Spacecraft exploration of the planets in our solar system and the discovery of exoplanets has been raised a great interest in atmospheric escape from planetary objects. The hydrodynamic escape problem (HEP) is significant on the study of the evolution of planetary atmospheres. In this talk, we establish the global transonic solutions for hydrodynamic escape problem (HEP), which is characterized by a free boundary value problem of Euler equation with gravity and heat. The global existence of transonic solutions to HEP is established by the generalized Glimm's method. The range of the hydrodynamic escape region in planetary atmospheres will also be discussed.

On the Semi-classical Limit of Quantum Zakharov System

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Abstract

In this talk,we study the Quantum Zakharov System in one spatial dimension. We investigate the semi-classical behavior of the system as the quantum parameter tends to zero. The result we obtained is slightly different from that of Boling Guo,Yanfeng Guo and Jingjun Zhang.

References

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An N-barrier maximum principle for traveling wave solutions of diffusive Lotka-Volterra systems

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Abstract

A new maximum principle for a class of autonomous elliptic systems which arise from the study of traveling wave solutions in reaction-diffusion equations is presented in [1]. By employing the N-barrier method, the N-barrier maximum principle (NBMP) for traveling wave solutions of diffusive Lotka-Volterra systems of two competing species is established. NBMP gives a priori estimates for the total mass of the two species. In this talk, we show that NBMP remains true for n ($n > 2$) species. In addition, a stronger lower bound in the NBMP is given by employing the tangent line method. As an application of NBMP, we establish a nonexistence result on traveling wave solutions of the Lotka-Volterra system. This is a joint work with Chiun-Chuan Chen and Li-Chang Hung.

References

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Distribution of First Arrival Position and Its Applications in Molecular Communication

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Abstract

In molecular communication systems, information is conveyed via nano-scale particles or molecules. Traditionally, the distribution of the first arrival time to the receiver is considered for system design and evaluation if nanoscale particles or molecules are diffused from the transmitter to the receiver in diffusion-based molecular communication systems. In this article, we consider an extra information in diffusion-based molecular communication system, namely the *first arrival position* at the receiver. A mathematical framework is developed to obtain the closed-form density function of the first arrival position for particles/molecules diffusing under constant net drift. The derived density function not only provides a novel analytical framework for existing molecular communication systems but may inspire novel molecular communication system design. The proposed methodology is general and can be extended to high dimensional Euclidean space.

References

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Performance Analysis for Distributed Compressive Sensing

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Abstract

In this talk, we introduce the distributed compressive sensing (DCS). In [1], D. Baron *et al*. characterized the fundamental performance limits of DCS recovery for jointly sparse signal ensembles in the noiseless measurement setting. However, the performance of DCS recovery is still not parameterized clearly. Our work aims to discuss how parameters affect the performance and extends DCS to take noise into account.

References

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The Numerical Approximation of Stationary Wave Solutions for Nonlinear Schrödinger Equations by using Petviashvili Iteration Method

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Abstract

In this talk, by using a modification Petviashvili iteration method we obtain the numerical approximations of stationary wave solutions for Nonlinear Schrödinger Equation(NSE). Due to the potential function in NSE, we need to modify the Petviashvili method for guarantee the convergence of numerical iteration in the approximation solutions. We simulate some cases of 1-D and 2-D equations respectively. From the numerical results, if the spectral radius of the numerical scheme less than one, we get quick convergence of the numerical method. In the future work, we plan to use this method to study the numerical solutions for two-component systems of self-focusing cubic Nonlinear Schrödinger Equations, Gross-Pitaevskii equation, etc.

Asymptotics of stationary solution for a cross-diffusion mass-conserved system

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Abstract

We study stationary solutions for a 1-D cross-diffusion system

$$\begin{aligned} u_t &= d\Delta u - g(u+v) + v, \\ v_t &= \Delta v + g(u+v) - v \end{aligned}$$

where $g(w) = w/(w+1)^2$. In particular, we are interested in asymptotic behaviours of the solution for the system as $d \to 0$. We show that the solution with a minimizing energy exhibits the phenomena of mass concentration. Using a blow-up technique, we also find the limiting profile for the solution. This is a joint work with Jann-Long Chern and Yoshihisa Morita.

References

[1] S. Jimbo and Y. Morita, *Lyapunov function and spectrum comparison for a reaction-diffusion system with mass conservation*, J. Differential Equations, **255**, 1657-1683 (2013).

[2] Jann-Long Chern, Yoshihisa Morita and Tien-Tsan Shieh, *Grand states of mass-conserved reaction-diffusion systems*, Dec. 2015, NCTS.

On extremals for a Radon-like transform

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Abstract

Let $f \in L_p(\mathbb{R}^n)$, $p = \frac{n+1}{n}$, $q = n+1$. The transform $\mathbf{T}$ with $\mathbf{T}(f) = f * \sigma$ admits an inequality $\|T(f)\|_q \leq \mathbf{A}\|f\|_p$, where $\mathbf{A}$ is the optimal constant. In this talk I shall present Prof. Christ's work in 2011, about the behavior when $f \in L_p(\mathbb{R}^n)$ is quasi-extremal i.e. $\|\mathbf{T}(f)\|_q \geq (1-\delta)\mathbf{A}\|f\|_p$ for small $\delta > 0$. Then we can prove the existence of an extremizer and have further application to near-extremal of a sharpened Young inequality.

References

[1] Michael Christ, *On extremals for a Radon-like transform*, math.CA arXiv:1106.0728

Ill-posedness of the quantum Zakharov system in one spatial dimension

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Abstract

In 2015, we proved the local well-posedness for the quantum Zakharov system in one spatial dimension. In the sequel, we continue the study of the quantum Zakharov system for the ill-posedness problem. In this talk, we present some results, such as "norm inflation" and data-to solution map not C^2, for the system.

Global analysis of predator-prey system with Hassell-Varley type functional response

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Abstract

In this talk, I would like to introduce a partial result which concerns the globally qualitative analysis of predator-prey model with Hassell-Varley type functional response. We show that, under some restrictions on parameters, the local stability of the positive steady state implies its global stability with respect to positive solutions. We first transform the original system into a better study one and then apply the Dulac criterion to establish the result.

A Parallel and Hybrid Linear System Solver

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Abstract

We develop a parallel linear system solver for sparse symmetric positive definite matrices. The solver uses k-way partitioning with vertex separators to reorder the coefficient matrix, performs Cholesky decomposition on subdomain matrices in parallel, and uses Conjugate Gradient method with LORASC preconditioner[1] to solve the Schur complement involving the separator matrix. The LORASC preconditioner is based on randomized SVD. Implementation is done by using C++ and numerical results will be discussed.

References

[1] Laura Grigori, Frédéric Nataf, and Soleiman Yousef, *Robust Algebraic Schur Complement Preconditioners Based on Low Rank Corrections* (2014).