

HYKE meeting 2022

August 29th (Monday)

- 10:30 - 11:00 강명주 박사 (서울대)

Title: Uniform stability of the generalized Kuramoto model and its application

Abstract: In this talk, we introduce the generalized Kuramoto (GK) model. We study uniform stability of the GK model and rigorous derivation of the continuum GK models. We prove uniform-in-time continuum limit from the GK model toward the continuum GK models. We first show that ℓ^p -distance between two configurations of the GK model is bounded by the constant times of the sum of ℓ^p -distances between initial data, natural frequency, and communication matrix. Then, we use the uniform ℓ^p -stability to construct a Cauchy sequence of simple functions which converges to a solution of the continuum GK model in supremum norm sense.

- 11:00 - 11:20 조향준 (서울대)

Title: Remark on the complete synchronization for the Kuramoto model with adaptive couplings

Abstract: In this talk, we study the complete synchronization for the Kuramoto model with adaptive couplings. For the coupling between the relative phases and mutual coupling strengths, we employ two types of coupling functions, namely “Hebbian coupling” and “anti-Hebbian coupling”, and provide several sufficient frameworks in terms of system parameters and initial data which yield the complete synchronization estimates. This improves earlier conditional complete synchronization estimates (Ha, Noh and Park in SIAM J. Appl. Dyn. Syst. 15: 162–194, 2016) assuming the a priori bound for the phase diameter. This talk is based on the joint work with Jiu-Gang Dong and Seung-Yeal Ha.

- 11:20 - 11:50 정진욱 박사 (서울대)

Title: Modulated energy estimates for singular kernels and their applications to asymptotic analyses for kinetic equations

Abstract: In this talk, we consider modulated interaction energy estimates for the kernel $K(x) = |x|^{-\alpha}$ with $\alpha \in (0, d)$, and its applications to quantified asymptotic analyses for kinetic equations. The proof relies on a dimension extension argument for an elliptic operator and its commutator estimates. For the applications, we first discuss the quantified small inertia limit of kinetic equations with singular nonlocal interactions. The aggregation equations with singular interaction kernels are rigorously derived. We also study the rigorous quantified hydrodynamic limit of the kinetic equation to derive the isothermal Euler or pressureless Euler system with the nonlocal singular interaction forces. This talk is based on the joint work with Prof. Young-Pil Choi (Yonsei University).

- 13:30 - 14:00 심우주 박사 (KIAS)

Title: Generalized Aggregation Model on Hilbert C*-modules

Abstract: In this talk, we discuss a new aggregation model on Hilbert C*-modules and study its emergent dynamics. Hilbert C*-module is a generalized notion of Hilbert space by allowing the inner product to take values in a C*-algebra rather than \mathbb{C} . The most simple form of our model encompasses various Kuramoto-type aggregation models that already exist, such as the Kuramoto model, the swarm sphere model, the Lohe matrix model, the group ring model, the Schrodinger-Lohe model, the complex sphere model in Hilbert space, Lohe tensor model and the Stiefel manifold model. For the proposed model, I would like to provide several sufficient criteria leading to the asymptotic aggregation of particles.

- 14:00 - 14:20 윤재영 (서울대)

Title: Active Swarm Model

Abstract: In this talk, we introduce a new model, “active swarm model”, with derivation. And also, some results of collective dynamics, especially “flocking”, are provided under various settings with conditions needed.

- 14:30 - 14:50 손성준 (성균관대)

Title: The ES-BGK model for the polyatomic molecules with infinite energy

Abstract: In this talk, we prove the existence and uniqueness of mild solutions to the ES-BGK model for polyatomic particle system of the initial data is not guaranteed to be finite.

- 14:50 - 15:20 이호 교수 (경희대)

Title: Small solutions of the Einstein-Boltzmann system coupled with a non-linear scalar field with Bianchi symmetries

Abstract: In this talk we study the Einstein-Boltzmann system coupled with a non-linear scalar field. The spacetime will be assumed to be of Bianchi types, and the Boltzmann equation will be considered as a matter model for the Einstein equations. The simplest way to describe an accelerated expansion of the universe is to introduce a positive cosmological constant, but one may consider a suitable non-linear scalar field to describe a more general type of acceleration. We will consider a non-linear scalar field having a positive lower bound so that an exponential expansion will be described. For the Boltzmann equation we will consider the spatially homogeneous relativistic Boltzmann equation with the scattering kernel for Israel particles. We obtain the global existence and the detailed asymptotic behavior.

- 15:40 - 16:10 배기찬 박사 (서울대)

Title: Shakhov model near a global Maxwellian

Abstract: "Shakhov model is a relaxation approximation of the Boltzmann equation proposed to overcome the deficiency of the original BGK model, namely, the incorrect production of the Prandtl number. In this talk, we address the existence and asymptotic stability of the Shakhov model when the initial data is a small perturbation of global equilibrium. We derive a dichotomy in the coercive estimate of the linearized relaxation operator between zero and non-zero Prandtl number and observe that the linearized relaxation operator becomes more degenerate in the former case. To fill out such degeneracy and recover the full coercivity, we consider a micro-macro equation that involves non-conservative quantities."

- 16:10 - 16:30 이명수 (성균관대)

Title: Relativistic BGK model for gas mixtures

Abstract: In this talk, we present a BGK-type model of the relativistic Boltzmann equation for gas mixtures, based on Marle's formulation. For this, we introduce a single global BGK-type operator for each species and determine the auxiliary parameters by imposing that our model satisfies the balance equations. And then we see that our model satisfies some basic properties. And we further see that our model can recover the classical BGK model in the Newtonian limit.

- 16:30 - 16:50 변준혁 (서울대)

Title: Asymptotic dynamics of nonlinear consensus model under singular communications

Abstract: We study asymptotic behaviors of a nonlinear consensus model. Depending on the regularity and singularity of communication weight at the origin and far-field, we study diverse clustering patterns for the collective behaviors of the proposed model.