Recent Developments in Hamilton–Jacobi Equations

These talks form the workshop component of IRCP 2026 and highlight recent developments related to the theme of the event: Hamilton–Jacobi equations. Some talks present new tools in dynamical systems, numerical methods such as policy iteration, and connections to spectral theory, as well as applications to adjacent fields. These talks are open to the public, in addition to the member-focused talks taking place the week before.
Organizers: Son Tu (Baylor) and Le Minh Ha (VIASM)

Workshop Schedule

Monday, June 8, 2026.

Time	**Speaker**	**Title**
8:45–8:50	Son Tu	Opening
8:50–9:40	John Lee	Poroelasticity problems: models, equations, and numerical methods
9:50–10:20		Coffee Break
10:20–11:10	Yeoneung Kim	Beyond the curse of dimensionality: Scalable policy iteration for HJB equations via neural operators
11:20–12:10	Jianlu Zhang	Topological instability of KAM torus
12:10–13:30		Lunch break
13:30-14:20	Truong-Son Van	A brief introduction to Coagulation-Fragmentation equations
14:30–15:00		Coffee Break
15:00–15:50	Zibo Wang	On the vanishing viscosity limit of Hamilton-Jacobi equations
16:00–17:00	Gengyiu Liu	Comparison principle of general Hamilton-Jacobi equations and applications

Tuesday, June 9, 2026.

Time	**Speaker**	**Title**
9:00–10:30		Open Discussion
10:30–11:00		Coffee Break
11:00–12:00		Open Discussion
12:00–13:30		Lunch break
13:30-15:00		Open Discussion
15:00–15:30		Coffee Break
15:30–17:00		Open Discussion

Abstracts

- Jianlu Zhang
  State Key Laborotary of Mathematical Sciences, Academy of Mathematics and systems science, Chinese Academy of Sciences, Beijing 100190, China

Topological instability of KAM torus

In 1998, Herman present a report concerning 7 topics of open problem in dynamical systems, of which the No. 6 problem asked if we can find a dense orbit on typical energy level for generic convex nearly integrable systems. In a recent work, we showed that KAM torus can be approximated by long range diffusion orbits, which partially answered the No. 6 problem. It is a joint work with C-Q Cheng.

- Zibo Wang
  State Key Laborotary of Mathematical Sciences,Academy of Mathematics and systems science, Chinese Academy of Sciences, Beijing 100190, China

On the vanishing viscosity limit of Hamilton-Jacobi equations

In this talk, we try to develop a unified framework for the vanishing viscosity limit of Hamilton-Jacobi equations within the class of Tonelli Hamiltonians. We also provide quantitative estimates on the rate of convergence. This is a joint work with Professor Jianlu Zhang.

- Truong-Son P. Van
  Fulbright University, Ho Chi Minh City, Vietnam.

A brief introduction to Coagulation-Fragmentation equations

In this talk, we discuss a class of kinetic equations called coagulation-fragmentation equations, whose applications are in atmospheric sciences, astrophysics, chemical engineering. We will briefly survey the literature then discuss several special cases where techniques from control theory prove to be useful.

- John Lee
  Baylor University, Waco, Texas, USA.

Poroelasticity problems: models, equations, and numerical methods

Poroelasticity provides a mathematical framework for describing the interaction between fluid flow and deformable porous solids, with applications ranging from geomechanics to biological tissues. In this talk, we present a concise overview of classical and modern poroelastic models, including Biot-type systems and their extensions. From a PDE perspective, these models exhibit a rich structure combining elliptic constraints for the solid deformation and parabolic diffusion for the fluid pressure, leading to a coupled differential-algebraic system with multiscale features. We will discuss key analytical aspects such as well-posedness as well as numerical challenges arising from stability and strong coupling. Particular emphasis will be placed on structure-preserving numerical methods and recent developments in discretization strategies for coupled systems. Numerical optimal control problems via the Karush-Kuhn-Tucker system will be also discussed.

- Gengyu Liu
  State Key Laborotary of Mathematical Sciences,Academy of Mathematics and systems science, Chinese Academy of Sciences, Beijing 100190, China

Comparison principle of general Hamilton-Jacobi equations and applications

In this talk, we investigate contact Hamilton-Jacobi equations

$$H(x, du, u) = c \qquad \text{and} \qquad H(x, du, u) = c + \Delta u$$

under the condition that the contact direction is not strictly positive definite. Correspondingly, we describe the structure of $\mathfrak{C}$ containing all the $c \in \mathbb{R}$ that makes the equations solvable and establish general comparison principles. As applications, we employ these comparison principles to obtain quantitative homogenization results.

- Yeoneung Kim
Seoul National University of Science and Technology, Dept. of Applied Artificial Intelligence, South Korea

Beyond the curse of dimensionality: Scalable policy iteration for HJB equations via neural operators

This presentation introduces a novel, scalable mathematical framework to overcome the 'curse of dimensionality' in solving Hamilton-Jacobi-Bellman (HJB) equations for optimal control. By combining classical Policy Iteration (PI) with Physics-Informed Neural Networks (PINNs), the proposed mesh-free approach decomposes fully nonlinear HJB equations into a sequence of continuous linear PDEs. We provide rigorous theoretical guarantees, including geometric convergence, uniform boundedness, and the strict non-accumulation of L^2 neural approximation errors across finite-horizon, infinite-horizon (deterministic and stochastic), and entropy-regularized exploratory settings. Evaluated on complex tasks, including a 50-dimensional stochastic LQR problem and nonlinear benchmarks, our framework achieves rapid stabilization and monotonic performance improvements, successfully outperforming standard model-free reinforcement learning algorithms like SAC and PPO.