Panrui Ni, PhD

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https://panrui-ni.github.io/ Birth: 16/07/1996

Research Interests

- Hamiltonian Dynamics, Hamilton-Jacobi Equations, Aubry-Mather Theory and Weak KAM Theory.
- During my PhD training, my project mainly focused on the *contact-type Hamilton-Jacobi equations*

$$H(x, Du(x), u(x)) = 0, \quad \text{and} \quad \partial_t u(x,t) + H(x, \partial_x u(x,t), u(x,t)) = 0.$$

  We use the Aubry-Mather theory for *contact Hamiltonian systems* to analyze the above two equations.

Academic Position

2023 – 2024 **Postdoc Faculty, Sorbonne Université, CNRS, IMJ-PRG, Paris, France**.
Research Project: *Discrete and continuous weak KAM theory*.
Mentor: Maxime Zavidovique

Education

2018 – 2023 **PhD, Fudan University, Shanghai, China** Mathematics.
Thesis title: *Viscosity solutions of contact-type Hamilton-Jacobi equations*.
Advisor: Jun Yan

2014 – 2018 **Bachelor, Southeast University, Nanjing, China** Engineering Mechanics.
Thesis title: *Variational principle for contact Hamiltonian systems and its applications*.
Advisor: Changwen Mi

Research Publications

Journal Articles

1. **Panrui Ni**, "Multiple asymptotic behaviors of solutions in the generalized vanishing discount problem," *Proceedings of the American Mathematical Society*, vol. 151, pp. 5239–5250, 2023, URL: https://doi.org/10.1090/proc/16420.
2. **Panrui Ni**, "Weakly coupled Hamilton-Jacobi systems without monotonicity condition: A first step," *Communications on Pure and Applied Analysis*, vol. 23, no. 7, pp. 961–983, 2024, URL: https://doi.org/10.3934/cpaa.2024042.

3. **Panrui Ni**, K. Wang, and J. Yan, "A weakly coupled mean field games model of first order for k groups of major players," *Proceedings of the American Mathematical Society, published online*, URL: https://doi.org/10.1090/proc/16342.

4. **Panrui Ni**, K. Wang, and J. Yan, "Viscosity solutions of contact Hamilton-Jacobi equations with Hamiltonians depending periodically on unknown functions," *Communications on Pure and Applied Analysis*, vol. 22, no. 2, pp. 668–685, 2023, URL: http://doi.org/10.3934/cpaa.2023005.

5. **Panrui Ni** and L. Wang, "A nonlinear semigroup approach to Hamilton-Jacobi equations–revisited," *Journal of Differential Equations*, vol. 403, pp. 272–307, 2024, URL: https://doi.org/10.1016/j.jde.2024.05.039.

6. **Panrui Ni** and L. Wang, "Aubry-Mather theory for contact Hamiltonian systems III," *Science China Mathematics, published online*, URL: https://link.springer.com/article/10.1007/s11425-022-2197-4.

7. **Panrui Ni**, L. Wang, and J. Yan, "A representation formula of the viscosity solution of the contact Hamilton-Jacobi equation and its applications," *Chinese Annals of Mathematics, Series B, to appear*, URL: https://arxiv.org/abs/2101.00446.

8. **Panrui Ni** and B. Shen, "On variation of action integral in Finsler gravity," *Annals of Physics*, vol. 404, no. 1, pp. 93–114, 2019. URL: https://doi.org/10.1016/j.aop.2019.02.009.

Preprints

1. **Panrui Ni**, "Time periodic solutions of first order mean field games from the perspective of Mather theory." URL: https://arxiv.org/abs/2401.07155.

2. **Panrui Ni** and L. Wang, "On Mather's Lipschitz graph theorem of the Aubry set for contact Hamiltonian systems," submitted.

3. **Panrui Ni** and M. Zavidovique, "Nonlinear and degenerate discounted approximation in discrete weak KAM theory." URL: https://arxiv.org/abs/2403.04563.

Skills

Languages	Chinese (Native), English (Fluent).
Software	Mathematica & Python

Miscellaneous Experience

Scholarships and Grants

2023	Award of Outstanding Graduate of Shanghai
2022	National Natural Science Foundation of China, **participant**, Grant No. 12171096.
2021	Qinghua Scholarship at School of Mathematical Sciences, Fudan University

Miscellaneous Experience (continued)

2020 Academic Scholarships for PhD Degree Students

2019 National Scholarship & Outstanding Student of Fudan University

Conference Activities

2024.1 ANR meeting, École Normale Supérieure de Lyon, **Invited speaker**.
Title: *On discrete nonlinear vanishing discount problem.*

2023.6 PDE seminar, University of Tokyo, **Invited speaker**.
Title: *Hamilton-Jacobi equations depending Lipschitz continuously on the unknown function.*

2022.7 Conference on Differential Equations and Dynamical Systems, Beijing Institue of Technology, **Invited speaker**.
Title: *A nonlinear semigroup approach to a class of nonmonotone Hamilton-Jacobi equations.*

Teaching Activities

2021 Teaching assistant in Fudan University, Course: *Calculus.*

2020 Teaching assistant in Fudan University, Course: *Classical Mechanics.*

2019 Teaching assistant in Fudan University, Course: *Classical Mechanics.*