CAO Zhongyuan

Ph.D in Applied Mathematics

zc3151@nyu.edu +86 13120976715 Homepage: https://yourlord666.github.io/homepage/

Research Interests

- •Mean field games and stochastic controls on networks
- •Financial networks and systemic risk
- •Graphon mean field Interacting systems.

Appointments

Postdoc in Mathematics at NYU Shanghai, since Oct. 2023.

Education

Université Paris Dauphine — INRIA (Paris center) Paris, Oct. 2020 – Sep.2023

Ph.D in applied mathematics

- **Thesis**: Systemic Risk, Complex Financial Networks and Graphon Mean Field Interacting Systems
- **Supervisors**: Prof. Agnès Sulem and Prof. Hamed Amini

Sorbonne Université (Pierre and Marie Curie campus) Paris, Sep. 2018 – Jun. 2020

M.Sc in Mathematics, specializing in Probability and Random Models

Jilin University Changchun, Sep. 2013 – Jun. 2017

B.Sc in Statistics (including financial Mathematics)

Experience

Research Visit Dec. 2024-Jan.2025

- INRIA-Paris Mathrisk team

Research Visit Jun. 2023

- University of Florida

Research internship in team Mathrisk at INRIA-Paris Apr. 2020-Jul. 2020

- **Subject**: Dynamic modelling and Control of systemic risk
- **Supervised** by Prof. Agnès Sulem and Prof. Hamed Amini.
- **Research**: Mean field games and systemic risk, networked ruin theory, contagion models in financial networks.

National Competition of mathematical modelling of China Dec. 2015

- 2nd prize

Competition of mathematical modelling of Jilin Province May. 2015

- 1st prize

Honors and Awards

- PhD fellowship of DIM Math Innov, Paris Foundation of Mathematical Sciences (FSMP).
- MOE Overseas Postdoc Special Program.

Teachings

Recitation

- *Probability & Statistics*, 2023 Fall, NYU Shanghai.
- *Probability & Statistics*, 2024 Spring, NYU Shanghai.
- *Calculus*, 2024 Spring, NYU Shanghai.
- *Calculus*, 2024 Fall, NYU Shanghai.
- *Calculus*, 2025 Spring, NYU Shanghai.
- *Linear Algebra*, 2025 Spring, NYU Shanghai.

Talks

1. Limit Theorems for Default Contagion and Systemic Risk, *INRIA Junior Seminar*, Paris, Sep 2021.

2. Limit Theorems for Default Contagion and Systemic Risk, *INFORMS Annual Conference*, Oct 2021.

3. Fire sales, default cascades and complex financial networks, *11th World Congress of the Bachelier Finance Society*, Jun 2022.

4. Graphon mean-field BSDEs with jumps and associated dynamic risk measures, *Groupe de Travail Méthodes Stochastiques et Finance*, ENPC, Paris, Jan 2023.

5. Graphon mean-field BSDEs with jumps and associated dynamic risk measures, *Financial Mathematics Seminar*, University of Michigan, Feb 2023.

6. Graphon mean-field BSDEs with jumps and associated dynamic risk measures, *SIAM Conference on Financial Mathematics and Engineering*, Philadelphia , Jun 2023.

7. Stochastic graphon mean field games with jumps and approximate Nash equilibria, Poster presentation, *43rd Conference on Stochastic Processes and their Applications*, Lisbon , Jul 2023.

8. Systemic Risk and Complex Financial Networks, *Postdoc Seminar*, NYU Shanghai , Nov 2023.

9. Mean field control of non-exchangeable systems *CSIAM 2024*, Nanjing, Oct 2024.

10. Probabilistic analysis of graphon mean field controls *NYU Shanghai Workshop on Optimal Controls, Mean Field Games and Machine Learning*, Shanghai, April 2024.

Publications and Preprints

1. Hamed Amini, **Zhongyuan Cao**, and Agnès Sulem. Limit theorems for default contagion and systemic risk. *Mathematics of Operations Research*, 49(4):2652–2683, 2024

2. Hamed Amini, **Zhongyuan Cao**, and Agnès Sulem. Fire sales, default cascades and complex financial networks. *Mathematics and Financial Economics*, 2025

3. Hamed Amini, **Zhongyuan Cao**, and Agnès Sulem. Graphon mean-field backward stochastic differential equations with jumps and associated dynamic risk measures. *Finance and Stochastics*, Forthcoming

4. Hamed Amini, **Zhongyuan Cao**, and Agnès Sulem. Ruin probabilities for risk processes in stochastic networks. *Available at SSRN 4355988, Submitted*, 2022

5. Hamed Amini, **Zhongyuan Cao**, and Agnès Sulem. Default cascade processes in stochastic financial networks. *ICAIF'23: Proceedings of the Fourth ACM International Conference on AI in Finance*, pages 227–234, 2023

6. Hamed Amini, **Zhongyuan Cao**, and Agnès Sulem. Stochastic graphon mean field games with jumps and approximate nash equilibria. *Available at SSRN 4412999 and under revision at SIAM Journal on Control and Optimization*, 2023

7. Hamed Amini, **Zhongyuan Cao**, and Agnès Sulem. Markovian equilibria of stochastic graphon games with jumps. *Available at SSRN 5074840, Submitted*, 2024

8. Hamed Amini, **Zhongyuan Cao**, and Agnès Sulem. Central limit theorems for price-mediated contagion in stochastic financial networks. *SIAM Journal of Financial mathematics*, Forthcoming

9. Hamed Amini, **Zhongyuan Cao**, Gökçe Dayanikli, Mathieu Laurière, Agnès Sulem, and Kexin Shao. Learning extended graphon mean field games. *In preparation*, 2025

10. **Zhongyuan Cao** and Mathieu Laurière. Probabilistic analysis of graphon mean field controls. *In preparation*, 2025

11. **Zhongyuan Cao** and Mathieu Laurière. Convergence of the deep BSDE method for coupled mean field FBSDEs. *In preparation*, 2025