Tian-Zhi Li

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Basic Information

I am currently at Peking University (PKU), working with Professors Zhisheng Duan and Jinzhi Wang. From Dec-2024 to Nov-2025, I was fortunate to work as a visiting PhD at Nanyang Technological University (NTU), Singapore, with Professor François Gay-Balmaz. Prior to that, I received my B.Sc. in Mathematics from Beijing Institute of Technology (BIT) in 2021 under the supervision of Professor Donghua Shi.

My research interest lies at the intersection of **Geometric Optimal Control**, **Stochastic Nonholonomic Mechanics**, and **Physics-Informed Learning** of robotic and mechanical systems. I am broadly interested in leveraging physical principles and differential geometry to develop computationally efficient algorithms for **control**, **estimation**, and **learning** with sound theoretical guarantees.

Academic Experience

- **Peking University** Sep 2021 - Jul 2026
  PhD (Dynamical Systems and Control)
- **Nanyang Technological University**, Singapore Dec 2024 - Nov 2025
  Visiting PhD (Mechanics and Control)
- **Beijing Institute of Technology** Sep 2017 - Jun 2021
  Bachelor of Science (Mathematics)

Teaching Experience

- Teaching Assistant, "Ordinary Differential Equations", Peking University Fall 2023
  Undergraduate-level course, covering more than 150 students
  Recieved **Outstanding Teaching Assistant Award**
- Teaching Assistant, "Linear Algebra", Peking University Spring 2023
  Undergraduate-level course, covering more than 150 students
- Teaching Assistant, "Linear Algebra", Peking University Fall 2022
  Undergraduate-level course, covering more than 150 students
  Delivered Lecture 5 "Determinants"
  Recieved **Outstanding Teaching Assistant Award**
- Teaching Assistant, "Analytic Mechanics", Peking University Spring 2022
  Undergraduate-level course, covering more than 100 students
- Teaching Assistant, "Ordinary Differential Equations", Peking University Fall 2021
  Undergraduate-level course, covering more than 150 students

Publications

[1] **T. Li** and J. Wang, Variational Unscented Kalman Filter on Matrix Lie Groups, **Automatica** (Regular Paper), 172: 111995, 2025. [Paper Link]

[2] **T. Li**, R. Fu, and J. Wang, Reduced Dynamics and Geometric Optimal Control of Nonequilibrium Thermodynamics: Gaussian Case, **Automatica** (Regular Paper), 164: 111626, 2024. [Paper Link]

[3] **T. Li** and J. Wang, Physics-Informed Gaussian Process Learning on Lie Groups, **Journal of Guidance, Control, and Dynamics**, 48 (11), pp. 2654-2662, 2025. [Paper Link]

[4] **T. Li**, J. Wang, and Z. Duan, Structure-Preserving Unscented Kalman Filter for Planar Mobile Robots, **IEEE Control Systems Letters**, vol. 9, pp. 2157-2162, 2025. [Paper Link]

[5] **T. Li**, F. Gay-Balmaz, D. Shi, and J. Wang, Variational Principle for Stochastic Nonholonomic

Systems **Part II**: Stochastic Nonholonomic Integrator. In: Nielsen, F., Barbaresco, F. (eds) Geometric Science of Information (**GSI'25**), Saint-Malo, France, vol. 16034, pp. 225-233. Springer, 2026. [Paper Link]

[6] **T. Li**, F. Gay-Balmaz, D. Shi, and J. Wang, Variational Principle for Stochastic Nonholonomic Systems **Part I**: Continuous-Time Formulation. In: Nielsen, F., Barbaresco, F. (eds) Geometric Science of Information (**GSI'25**), France, vol. 16034, pp. 204-213. Springer, 2026. [Paper Link]

[7] **T. Li** and J. Wang, A Structure-Preserving Learning Scheme on SO(3), 2024 43rd IEEE Chinese Control Conference (**CCC'24**), Kunming, China, 2024, pp. 5149-5152. [Paper Link]

[8] **T. Li** and J. Wang, Multisymplectic Unscented Kalman Filter for Geometrically Exact Beams. In: Nielsen, F., Barbaresco, F. (eds) International Conference on Geometric Science of Information (**GSI'23**). Lecture Notes in Computer Science, Saint-Malo, France, vol. 14072, pp. 60-68, Springer Verlag. [Paper Link]

[9] **T. Li** and J. Wang, A Physics-Informed Gaussian Process Regression Algorithm for The Dynamics of The Planar Pendulum, 2023 42nd IEEE Chinese Control Conference (**CCC'23**), Tianjin, China, pp. 5163-5167, 2023. [Paper Link]

[10] **T. Li** and J. Wang, A Statistical Dynamical Algorithm for Gaussian Multi-Agent Systems Under Hamel's Formalism, 34th IEEE Chinese Control and Decision Conference (**CCDC'22**), Hefei, China, pp. 1344-1349, 2022. [Paper Link]

Honors and Awards

- **National Scholarship** (top 1%) — Sep-2025
  Issued by Ministry of Education, China
- **Merit Student** — Dec-2025
  Issued by Beijing Education Commission
- **Presidential Doctoral Scholarship** — Jun-2025
  (The most prestigious scholarship issued by Peking University)
- **China Scholarship Council Visiting PhD Scholarship** — Jul-2024
  Issued by China Scholarship Council
- **Merit Student** (top 1%) — Sep-2025
  Issued by Peking University
- **Excellent Academic Research Award** (top 1%) — Sep-2025
  (only 2 awardees at SAMR, Peking University)
- **Dean's Doctoral Scholarship - First Prize** — Oct-2024
  Issued by College of Engineering, Peking University
- **Yuehua Luo Scholarship** — Nov-2024
  Issued by Peking University
- **Outstanding Teaching Assistant Award** ($\times$ 2) — Mar-2024 & Apr-2023
  Issued by College of Engineering, Peking University

Invited Talks & Conference Talks

- Variational Principle for Stochastic Nonholonomic Systems Part II: Stochastic Nonholonomic Integrator
  The International Conference on Geometric Science of Information (GSI)
  Saint-Malo, France, Oct-2025
- Variational Principle for Stochastic Nonholonomic Systems Part I: Continuous-Time Formulation
  The International Conference on Geometric Science of Information (GSI)
  Saint-Malo, France, Oct-2025
- Stochastic Hamel's Formalism for Finite-Dimensional Mechanical Systems

The 34th Chinese Congress of Theoretical and Applied Mechanics (CCTAM)
Changsha, China, Jul-2025

- A Structure-Preserving Learning Scheme on SO(3)
The 43rd Chinese Control Conference (CCC)
Kunming, China, Jul-2024
- Multisymplectic Unscented Kalman Filter for Geometrically Exact Beams
International Conference on Geometric Science of Information (GSI)
Saint-Malo, France, Aug-2023
- A Physics-Informed Gaussian Process Regression Algorithm for the Dynamics of the Planar Pendulum
The 42nd Chinese Control Conference (CCC)
Tianjin, China, Jul-2023
- A Statistical Dynamical Algorithm for the Dynamics of Gaussian Distributions
The 34th Chinese Control and Decision Conference (CCDC)
Hefei, China, Aug-2022
- Stochastic Variational Principles for Constrained Systems (Invited by Prof. Donghua Shi)
Geometric Mechanics & Control Seminar, Beijing Institute of Technology, Jul-2025.
- Geometric Structures and Optimal Control of Gaussian Distributions
Workshop on Multibody System Dynamics, School of Aerospace Engineering, Beijing Institute of Technology, Apr-2024. (Invited by Profs. Qiang Tian and Ju Chen)
- Variational Unscented Kalman Filter on Matrix Lie Groups (Invited by Prof. Donghua Shi)
School of Mathematics and Statistics, Beijing Institute of Technology, Jul-2025.

References

Professor Zhisheng Duan
Position: Professor of Dynamics and Control
Deputy Director of State Key Laboratory for Turbulence & Complex Systems
Affiliation: Peking University
E-mail: duanzs@pku.edu.cn

Professor François Gay-Balmaz
Position: Associate Professor of Mathematics
Affiliation: Nanyang Technological University
E-mail: francois.gb@ntu.edu.sg

Professor Jinzhi Wang
Position: Professor of Dynamics and Control
Affiliation: Peking University
E-mail: jinzhiw@pku.edu.cn

Professor Donghua Shi
Position: Associate Professor of Mathematics
Director of Beijing Key Laboratory on MCAACI
Affiliation: Beijing Institute of Technology
E-mail: dshi@bit.edu.cn