

**Contact  
Information**

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**Personal  
Statement**

I have broad interests in applied mathematics, nonlinear dynamics, stochastic dynamics, random vibration and control, machine learning as well as their applications in various areas of engineering and applied science. I have published more than 20 peer-reviewed high-quality academic papers in SCI-indexed journals. In particular, an invited article in *Chaos* was selected as the **Featured Article** and an article in *Science China Technological Sciences* was selected as the **2022 High Impact Paper of Science China Technological Sciences**. I was also invited to give a 40-minute **Plenary Speech** at the IUTAM Symposium on Data-driven Nonlinear and Stochastic Dynamics with the Control held in China from June 5-9, 2023. Additionally, I was awarded the **First Prize** of Postgraduate Innovation Achievement Award of Shaanxi Province in 2022 as the 1st winner (Top 1%).

**Education  
Experiences**

2016.09–2021.12, *D.Sc. in Mathematics, Northwestern Polytechnical University (NPU), China*  
 – Supervisor: **Prof. Yong Xu, Alexander von Humboldt Research Fellow (Experienced Researchers), National Distinguished Young Scholars of China**  
 2012.09–2016.07, *B.Sc. in Statistics, Northwestern Polytechnical University (NPU), China*

**Work  
Experiences**

2023.02–Present, *Postdoctoral Research Fellow, Tokyo Institute of Technology, Japan*  
 – Supervisor: **Prof. Hiroya Nakao**

**Research  
Experiences**

2019.11–2020.06, *Visiting Scholar, Humboldt University of Berlin, Germany*  
 – Supervisor: **Prof. Jürgen Kurths, Member of the Academia Europaea, Editor-in-Chief of Chaos**  
 2018.08–2018.08, *Visiting Scholar, Potsdam Institute for Climate Impact Research, Germany*  
 – Supervisor: Prof. Jürgen Kurths  
 2018.04–2018.05, *Visiting Scholar, Potsdam Institute for Climate Impact Research, Germany*  
 – Supervisor: Prof. Jürgen Kurths

**Research  
Interests**

Applied Mathematics, Nonlinear Dynamics, Stochastic Dynamics, Random Vibration and Control, Bifurcation and Chaos, Approximate Methods, Data-Driven Techniques, Machine Learning

**Publications**

Selected journal papers are listed as follows.

- **Q. Liu**, Y. Xu, Y.G. Li, Complex dynamics of a conceptual airfoil structure with consideration of extreme flight conditions, *Nonlinear Dyn* 111 (2023) 14991–15010.
- **Q. Liu**, Y. Xu, J. Kurths, X.C. Liu, Complex nonlinear dynamics and vibration suppression of conceptual airfoil models: A state-of-the-art overview, *Chaos* 32 (2022) 062101. (**Featured Article**)
- **Q. Liu**, Y. Xu, Y.G. Li, J. Kurths, X.C. Liu, Fixed-interval smoothing of an aeroelastic airfoil model with cubic or free-play nonlinearity in incompressible flow, *Acta Mech Sin* 37 (2021) 1168–1182.
- **Q. Liu**, Y. Xu, J. Kurths, Bistability and stochastic jumps in an airfoil system with viscoelastic material property and random fluctuations, *Commun Nonlinear Sci Numer Simulat* 84 (2020) 105184.
- **Q. Liu**, Y. Xu, C. Xu, J. Kurths, The sliding mode control for an airfoil system driven by harmonic and colored Gaussian noise excitations, *Appl Math Modell* 64 (2018) 249–264.
- **Q. Liu**, Y. Xu, J. Kurths, Active vibration suppression of a novel airfoil model with fractional order viscoelastic constitutive relationship, *J Sound Vib* 432 (2018) 50–64.

- Y. Xu, **Q. Liu**, G.B. Guo, C. Xu, D. Liu, Dynamical responses of airfoil models with harmonic excitation under uncertain disturbance, *Nonlinear Dyn* 89 (2017) 1579–1590.
- J.Z. Ma, **Q. Liu**, Y. Xu, J. Kurths, Early warning of noise-induced catastrophic high-amplitude oscillations in an airfoil model, *Chaos* 32 (2022) 033119.
- R. Guo, **Q. Liu**, J.L. Li, Y. Xu, Response statistics of a shape memory alloy oscillator with random excitation, *Appl Sci* 11 (2021) 10175.
- X.L. Du, Y. Xu, **Q. Liu**, C.C. Liu, X.L. Yue, X.C. Liu, J. Kurths, Shimmy dynamics in a dual wheel nose landing gear with freeplay under stochastic wind disturbances, *Nonlinear Dyn* 112 (2024) 2477–2499.
- J. Feng, X.L. Wang, **Q. Liu**, Y.G. Li, Y. Xu, Deep learning-based parameter estimation of stochastic differential equations driven by fractional Brownian motions with measurement noise, *Commun Nonlinear Sci Numer Simulat* 127 (2023) 107589.
- D. Zhao, Y.G. Li, **Q. Liu**, H.K. Zhang, Y. Xu, The occurrence mechanisms of extreme events in a class of nonlinear Duffing-type systems under random excitations, *Chaos* 33 (2023) 083109.
- H. Zhang, Y. Xu, **Q. Liu**, Y.G. Li, Deep learning framework for solving Fokker-Planck equations with low-rank separation representation, *Eng Appl Artif Intel* 121 (2023) 106036.
- H. Zhang, Y. Xu, **Q. Liu**, X.L. Wang, Y.G. Li, Solving Fokker-Planck equations using deep KD-tree with a small amount of data, *Nonlinear Dyn* 108 (2022) 4029–4043.
- X.L. Wang, J. Feng, **Q. Liu**, Y.G. Li, Y. Xu, Neural network-based parameter estimation of stochastic differential equations driven by Lévy noise, *Physica A* 606 (2022) 128146.
- X.Y. Zhang, Y. Xu, **Q. Liu**, J. Kurths, C. Grebogi, Rate-dependent bifurcation dodging in a thermoacoustic system driven by colored noise, *Nonlinear Dyn* 104 (2021) 2733–2743.
- X.Y. Zhang, Y. Xu, **Q. Liu**, J. Kurths, C. Grebogi, Rate-dependent tipping and early warning in a thermoacoustic system under extreme operating environment, *Chaos* 31 (2021) 113115.
- X.Y. Zhang, Y. Xu, **Q. Liu**, J. Kurths, Rate-dependent tipping-delay phenomenon in a thermoacoustic system with colored noise, *Sci China Technol Sci* 63 (2020) 2315–2327. **(2022 High Impact Paper of Science China Technological Sciences, only 16 papers were selected out of about 230 articles)**
- W.L. Guo, Y. Xu, **Q. Liu**, S. Lenci, G.N. Li, Reliability of hypersonic airfoil with freeplay and stochasticity via nonlinear energy sink, To appear in *AIAA J*, April 2024.
- X.L. Wang, J. Feng, **Q. Liu**, Y. Xu, Noise-induced alternations and data-driven parameter estimation of a stochastic perceptual model, To appear in *Eur Phys J Spec Top*, April 2024.
- W.L. Guo, Y. Xu, Y.G. Li, **Q. Liu**, X.C. Liu, Dynamic responses of a conceptual two-dimensional airfoil in hypersonic flows with random perturbations, *J Fluid Struct* 121 (2023) 103920.
- D. Zhao, Y.G. Li, Y. Xu, **Q. Liu**, J. Kurths, Probabilistic description of extreme oscillations and reliability analysis in rolling motion under stochastic excitation, *Sci China Technol Sci* 66 (2023) 2586–2596.
- D. Zhao, Y.G. Li, Y. Xu, **Q. Liu**, J. Kurths, Extreme events in a class of nonlinear Duffing-type oscillators with a parametric periodic force, *Eur Phys J Plus* 137 (2022) 314.
- Y. Xu, H. Zhang, Y.G. Li, K. Zhou, **Q. Liu**, J. Kurths, Solving Fokker-Planck equation using deep learning, *Chaos* 30 (2020) 013133.

## Preprints

- J. Feng, X.L. Wang, **Q. Liu**, Y. Xu, J. Kurths, Fusing deep learning features for parameter identification of a stochastic airfoil system, *Nonlinear Dyn*, April 2024, Under Review.
- X.P. Shi, Y.G. Li, Y. Xu, **Q. Liu**, Complex Dynamics of a Magnetic Microrobot Driven by Single Deformation Soft Tail in Random Environment, *Theor Appl Mech Lett*, April 2024, Under Review.
- J.Z. Ma, D.Y. Li, R.F. Wang, **Q. Liu**, Y. Xu, T. Kapitaniak, J. Kurths, Predicting catastrophic high-amplitude oscillations in an airfoil system under extreme flight environment, *Int J Non-Linear Mech*, October 2023, Under Review.
- X.L. Du, Y. Xu, **Q. Liu**, C.C. Liu, Research progress on shimmy control of aircraft landing gear systems, *J Vib Engineering*, September 2023, Under Review.

## Projects

- The Innovation Foundation for Doctor Dissertation of NPU (No. CX201962), 2019.01-2020.12, **Principal Investigator** (only 3 items in Applied Mathematics, Top 5%);
- The National NSF of China (No. 12072264), 2021.01-2024.12, **First Participant**;
- The National NSF of China (Nos. 12120101002, 12142211, 11772255), Participant;
- The NSF of Chongqing (No. cstc2021jcyi-msxmX0738), 2021.07-2024.06, **First Participant**;

- The Open Project Foundation of State Key Laboratory of Airfoil and Cascade Aerodynamics, NPU (No. 614220121020211), 2022.01-2023.12, **First Participant**;
- The Xi'an Association for Science and Technology Youth Talent Support Program (No. 095920211337), 2021.06-2023.05, Third Participant;
- The Seed Foundation (Key Program) of Innovation and Creation for Postgraduate Students, NPU (No. ZZ2018027), 2018.01-2018.12, Third Participant.

## Honors and Awards

- The Outstanding Doctoral Dissertation Award of NPU (Top 3%), April 2024;
- The **First Prize** of the Science and Technology Award of Shaanxi Society for Vibration Engineering (as the fourth winner), Shaanxi Society for Vibration Engineering, China, 2023;
- The Sino-German (CSC-DAAD) Postdoc Scholarship (**only 50 people were selected**), 2021;
- The 2022 **High Impact Paper Award** of the Science China Technological Sciences (as the third author, only 16 papers were selected out of about 230 articles), Science China Press, 2023;
- The **First Prize** of the Sixth Postgraduate Innovation Achievement Award (as the first winner), Education Department of Shaanxi Provincial Government, 2022;
- The First Prize of the 1st Postgraduate Forum of School of Mathematics and Statistics, NPU, 2022;
- The **First Prize** of the Third Postgraduate Innovation Achievement Award (as the sixth winner, **only 1 item in Science in NPU**, Top 1%), Education Department of Shaanxi Provincial Government, 2017;
- The First-Class Academic Scholarship of NPU (Doctor) (2 times, Top 10%), 2017, 2018;
- The Outstanding Postgraduate of NPU (Doctor) (2 times, Top 10%), 2017, 2018;
- The Second-Class Special Scholarship of Beijing Jingdiao, Beijing Jingdiao Group, 2016;
- The Excellent Undergraduate Thesis of NPU (Top 5%), 2016;
- The Second Prize of the Preliminary Round of the Fifth National University Mathematics Competition (Mathematics Category) (Top 1%), Chinese Mathematical Society, 2014;
- The National Encouragement Scholarship for Undergraduate Students, China (Top 3%), 2013;
- The Outstanding Student of NPU (Bachelor) (2 times, Top 5%), 2013, 2014;
- The Second Prize of the Mathematical Modeling Competition of NPU (2 times, Top 5%), 2013, 2014;
- The Third Prize of the Pure Mathematics Competition of NPU, 2013.

## Conferences

### Invited Talks

- “Nonlinear dynamics and vibration suppression of conceptual airfoil models with random loads”, IUTAM Symposium on Data-driven Nonlinear and Stochastic Dynamics with the Control, June 5-9, 2023, Xi'an, Shaanxi, China (**Plenary Speech, 40 minutes**);
- “Complex dynamics and vibration suppression of conceptual airfoil models with random loadings”, The 3rd Edition of Mechanical and Aerospace Engineering Virtual 2024 (V-MAE2024), April 12-13, 2024, Online Conference (**Invited Speaker, 20 minutes**);
- “Nonlinear dynamics and control of an airfoil model with random fluctuations”, The 8th International Conference on Vibration Engineering (ICVE 2021), July 24-26, 2021, Shanghai, China (**Session Invited Talk, 25 minutes**).

### Chairman

- Scientific Session on the topic of “Recent advances in stochastic nonlinear dynamics: modeling, data analysis”, The 10th International Congress on Industrial and Applied Mathematics (ICIAM 2023), Aug 20-25, 2023, Tokyo, Japan.

### Oral Presentations

- “Complex dynamics of a conceptual airfoil structure with consideration of extreme flight conditions”, Scientific Session on the topic of “Recent advances in stochastic nonlinear dynamics: modeling, data analysis”, The 10th International Congress on Industrial and Applied Mathematics (ICIAM 2023), Aug 20-25, 2023, Tokyo, Japan (**25 minutes**);
- The 3rd International Nonlinear Dynamics Conference (NODYCON 2023), June 2023, Rome, Italy;
- The 1st International Conference on Mechanical System Dynamics, Nov 2021, Nanjing, China;
- The 1st Postgraduate Forum of School of Mathematics and Statistics, NPU, Nov 2021, Xi'an, China;
- The 2nd National Academic Forum for Doctoral Students in Mechanics, Oct 2021, Hangzhou, China;
- The 6th Cross-Strait Symposium on Dynamics, Vibration and Control, July 2021, Hohhot, China;

- The 18th National Conference on Nonlinear Vibration and 15th National Conference on Nonlinear Dynamics and Motion Stability, May 2021, Guangzhou, China;
- The 2nd International Nonlinear Dynamics Conference (NODYCON 2021), Feb 2021, Rome, Italy;
- The First Online Conference on Nonlinear Dynamics and Complexity, Nov 2020, USA;
- The 12th National Conference on Theory and Applied Stochastic Vibration and 9th National Conference on Stochastic Dynamics, Oct 2020, Chongqing, China;
- The 2019 Chinese Congress of Theoretical and Applied Mechanics, Aug 2019, Hangzhou, China;
- The 17th National Conference on Nonlinear Vibration and 14th National Conference of Nonlinear Dynamics and Motion Stability, May 2019, Nanjing, China;
- The 11th National Conference on Theory and Applications of Stochastic Vibration and 7th National Conference on Stochastic Dynamics, Oct 2018, Yichang, China.

#### **Poster Presentations**

- The International Workshop on Dynamics, Nonlinearity and Stochasticity, Apr 2019, Xi'an, China;
- The 5th International Congress on Dynamics, Vibration and Control, July 2018, Shijiazhuang, China;
- The 6th National Academic Conference on Stochastic Dynamics, Sep 2017, Weihai, Shandong, China.

#### **Others**

- The 25th International Congress of Theoretical and Applied Mechanics, Aug 2021, Milano, Italy;
- The 3rd National Conference on Big Data and Artificial Intelligence, July 2021, Chengdu, China;
- The Academic Forum on Data Science and Data Intelligence and Data Science Section 2021 Annual Academic Conference, July 2021, Guiyang, China;
- The 1st Conference on Data Science and Stochastic Dynamics, May 2021, Yinchuan, China.

#### **Additional Activities**

##### **Journal Reviewer**

International Journal of Mechanical Sciences, Aerospace Science and Technology, Chaos Solitons and Fractals, ISA Transactions, Nonlinear Dynamics, Chaos, Physics of Fluids, Signal Processing, Theoretical and Applied Mechanics Letters, European Physical Journal Special Topics, Physica Scripta, International Journal of Aerospace Engineering, Mathematics, Machines

#### **Professional Skills**

##### **Programming Language**

Matlab, Python, L<sup>A</sup>T<sub>E</sub>X, C/C++, Fortran, Maple

##### **Package or Framework**

NumPy, Matplotlib, SciPy, Seaborn, Tensorflow