# Brief CV of Dr Zepeng Liu

**Name:** Zepeng Liu
**Institute:** School of Engineering, Newcastle University, UK
**Position:** Lecturer in Electrification

## Working Experience:

- 2023/09-Present: Lecturer In Electrification at Newcastle University, UK.
- 2020/12-2023/09: Research Associate in Advanced Manufacturing Systems Condition monitoring at the University of Sheffield, UK
- 2020/5-2020/8: Research Associate at the University of Manchester, UK

## Education Background:

- 2017/1-2021/2: Ph.D in the Department of Electrical & Electronic Engineering at the University of Manchester, UK
- 2015/9–2016/9: MSc in the Department of Power Systems Engineering at the University College London, UK
- 2013/9–2015/6: BEng in the Department of Electrical Engineering & Electronics at the University of Liverpool, UK

## Research Interests:

- Data-Driven Modelling
    1. Nonlinear system modelling and analysis in the frequency domain
    2. Machine and statistical learning, Neural networks
    3. Sparse representation and nonlinear filtering
- Modelling and analysis for complex systems
    1. Advanced manufacturing
    2. Condition monitoring and fault detection of wind turbine systems and components
    3. Structural health monitoring
    4. Smart structures and systems
    5. Application of machine learning to machinery fault diagnosis

## Research Experience:

- **Research associate project about autonomous method for detecting cutting tool and machine tool anomalies in machining.** The achievements include developing an online monitoring system for cutting tool condition monitoring and fault diagnosis (CMFD). The online monitoring system was developed based on nonlinear system modelling and nonlinear frequency analysis aiming to address challenges in advanced manufacturing-related machining process monitoring. This new monitoring techniques are more noise tolerant, and the physical information of the underlying machining process is incorporated into the modelling procedure. These can be extended to address process monitoring in many other industrial processes including safety-critical systems such as robotic arms used in nuclear power plant maintenance and quality-critical manufacturing such as drilling in aircraft manufacturing. Furthermore, as feature extraction is a necessary and important step for applying any machine learning technique in practice, the proposed nonlinear system modelling and nonlinear frequency analysis-based feature extraction for complex processes are also of significance for engineering applications of machine learning techniques. The outcomes of this project have also been published in some leading journals such as IEEE T SYST MAN CY-S, IEEE T IND INFORM, etc. This job was acknowledged by the department, and I received Recognition Award in recognition of my great efforts and excellent works on industrial-scale experimental studies.
- **PhD and research associate project about development and demonstration of methods and tools for large scale wind turbine pitch system condition assessment.** In this project, under my design and supervision, the first industrial-scale experimental test-rig for pitch systems was built in Europe. After that, I developed sensing tools using vibration and acoustic emission measurements in order to conduct real-time CMFD. For the CMFD of large slow-speed pitch systems, the fundamental technical challenges are that the collected signals are weak, noisy, and non-stationary. To solve these problems, some novel algorithms with sparse signal separation, nonlinear filtering, data fusion, nonlinear system identification and machine learning methods were proposed, followed by significant demonstration activities in both labs and real-world operating environments. The results of this project have been published in some leading and top journals in this field such as IEEE T IND ELECTRON, IEEE T IND INFORM, IEEE T INSTRUM MEAS, RENEWABLE ENERGY, etc. This work is unique and has been recognized by experts including the Chinese Scholarship Council (CSC). In 2022, I received the Chinese Government Award for Outstanding Self-financed Students Abroad (only 45 students in the UK received the award each year).

## Teaching Experience:

- I have been working as a Teaching Assistant for several MSc courses at the University of Manchester since 2016, e.g., Control Fundamental, State-Space and Multivariable Control, Control Systems, Robust and Optimal Control,

etc. In addition to this, I am currently helping my supervisors to supervise PhD students and undergraduate/postgraduate projects, some of them have generated high-quality research outputs.

**Professional activities and recognitions:**

- Review editor of Frontiers in Robotics and AI
- Reviewer of research papers for learned journals in a wide range of science and engineering subject areas

**Grant Application Experience:**

- Participated to the grant application of the project "Development and demonstration of methods and tools for large scale wind turbine pitch bearing condition assessment (DemoBearing)" (EP/S017224/1, £169,123).
- Participated to the grant application of the project "AI-Enabled Condition Monitoring, Fault Diagnosis, and Resilient Control of Wind Energy Systems" (Seed Grant Program, £ 14,000).
- Prepare for an EPSRC grant entitled "Digital Twin-Based Anomaly Detection Methods for Real-time Machine-Tool Condition Monitoring in Machining" (Please see my research statement for more detail).

**Selected Publications:**

**∗ indicates the corresponding author.**

Journal papers

[J1] **Z.Liu**, Z Q.Lang, Y.Zhu, Y.Gui, H.Laalej, and Jon.Stammers, "Sensor Data Modelling and Model Frequency Analysis for Detecting Cutting Tool Anomalies in Machining." *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, Accepted/In press. [IF: 11.471].

[J2] **Z.Liu**, X.Tang, X.Wang, J.Mugica and L.Zhang, "Wind Turbine Blade Bearing Fault Diagnosis Under Fluctuating Speed Operations via Bayesian Augmented Lagrangian Analysis." *IEEE Transactions on Industrial Informatics*, 17(7), pp.4613-4623, July 2021. [IF: 11.648].

[J3] **Z.Liu**, B.Yang, X.Wang, and L.Zhang, "Wind Turbine Blade Bearing Fault Detection Under Low Speed and Heavy Load Conditions Using Sparse Augmented Lagrangian Analysis." *IEEE Transactions on Industry Applications*, 57(3), pp.2791-2800, May-June 2021. [IF: 4.079]

[J4] **Z.Liu**, X.Wang, and L.Zhang, "Fault Diagnosis of Industrial Wind Turbine Blade Bearing using Acoustic Emission Analysis." *IEEE Transactions on Instrumentation and Measurement*, 69(9), pp. 6630-6639, Sept. 2020. [IF: 5.332]

[J5] **Z.Liu**, L.Zhang, and J.Carrasco, "Vibration analysis for large-scale wind turbine blade bearing fault detection with an empirical wavelet thresholding method." *Renewable Energy*, 146, pp.99-110, 2020. [IF: 8.634, **ESI highly cited article**]

[J6] **Z.Liu** and L.Zhang,"Naturally Damaged Wind Turbine Blade Bearing Fault Detection Using Novel Iterative Nonlinear Filter and Morphological Analysis." *IEEE Transactions on Industrial Electronics*, 67(10), pp.8713-8722, Oct. 2020 (2019). [IF: 8.162]

[J7] **Z.Liu**, and L.Zhang, "A review of failure modes, condition monitoring and fault diagnosis methods for large-scale wind turbine bearings." *Measurement*, p.107002, 2019. [IF: 5.131, **ESI highly cited article**]

[J8] C.Zhang, **Z.Liu**,and L.Zhang, "Wind Turbine Blade Bearing Fault Detection with Bayesian and Adaptive Kalman Augmented Lagrangian Algorithm." *Renewable Energy*, 199 (2022): 1016-1023. [IF: 8.162].

[J9] X.Wang, **Z.Liu**, L.Zhang, and W.Heath, "Wavelet Package Energy Transmissibility Function and Its Application to Wind Turbine Blade Fault Detection." *IEEE Transactions on Industrial Electronics*, vol. 69, no. 12, pp. 13597-13606, Dec. 2022. [IF: 8.162]

[J10] S.Ma, Y.Zhang, **Z.Liu**, X.Dai, J.Huang, P.Fan, B.Xie, S.Jiang, and H.Zhang, "Preparation and enhanced electric-field-induced strain of textured 91BNT–6BT–3KNN lead-free piezoceramics by TGG method." *Journal of Materials Science: Materials in Electronics*, 27(3), pp.3076-3081, 2016. [IF: 2.779]

[J11] Y.Zhu, Y.Zhao, Z Q.Lang and **Z.Liu** and Yang Liu, "On-line Rotor Systems Condition Monitoring Using Nonlinear Output Frequency Response Functions under Harmonic Excitations." *IEEE Transactions on Industrial Informatics*, 18.10 (2022): 6798-6808. [IF: 11.648]

[J12] X.Qin, W.Huang, X.Wang, Z.Tang and **Z.Liu∗**, "Real-time Remaining Useful Life Prediction of Cutting Tools Using Sparse Augmented Lagrangian Analysis and Gaussian Process Regression." *Sensors*, 23(1), pp.413, 2023 [IF: 3.85]

Conference papers

[C1] **Z.Liu** and L.Zhang, "Acoustic Emission Analysis for Wind Turbine Blade Bearing Fault Detection Using Sparse Augmented Lagrangian Algorithm." *2020 IEEE Applied Power Electronics Conference and Exposition (APEC)*, New Orleans, LA, USA, 2020, pp. 145-151.

[C2] X.Wang and **Z.Liu∗**, "Remaining Useful Life Estimation of Cutting Tools Using Bayesian Augmented Lagrangian Algorithm." *2022 IEEE 31st International Symposium on Industrial Electronics (ISIE)*, 2022, pp. 1165-1169.

[C3] Y.Gui, ZQ.Lang, **Z.Liu**, Y.Zhu, H.Laalej, "Time-Sensor Domain Data Decomposition and Analysis for Fault Diagnosis of Cutting Tools." *2022 17th International Conference on Control, Automation, Robotics and Vision (ICARCV)*, 2022, pp. 187-192.