

# Zhibin Zhao

PHD CANDIDATE

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## RESEARCH BACKGROUND

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Main Research

- **Signal Processing and Machine Learning**
- **Sparse Representation and Dictionary Learning**
- **Prognostics and Health Management**
- **Blade Tip Timing**
- **Deep Learning**

Other Research

- **Machine Learning** Applications (Self-study of machine learning, *deep learning from coursera*, and CS231N)
- **Convex Optimization** Algorithms (*Self-study of Ryan Tibshirani's and Stephen Boyd's courses*)

## EDUCATION

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### Xi'an Jiaotong University (Top University in China, C9)

Xi'an

PH.D. CANDIDATE IN MECHANICAL ENGINEERING (GPA: 3.8/4.0)

Sep. 2015 - PRESENT

- Supervisor: Prof Xuefeng CHEN

### Xi'an Jiaotong University

Xi'an

B.E. IN MECHANICAL ENGINEERING (*Hsue-Shen Tsien Class: Top %1*)

Sep. 2011 - Jun. 2015

- Thesis title: Research on Health Maintenance System Model

### National Central University

Taiwan

VISITING STUDENT IN MECHANICAL ENGINEERING

Sep. 2013 - Jan. 2014

## RESEARCH PROJECTS

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### Research on sparse prior modeling of vibration signal with few measured points

LEADER

Mar. 2019 - PRESENT

### Residual useful life prediction of machine tools

LEADER

Nov. 2018 - PRESENT

- Prediction of residual useful life prediction of machine tools through PLC data, current and vibration signal

### Fault prediction on engineering equipments based on machine learning

LEADER

Jun. 2018 - Sep. 2018

- Fault prediction modeling of collected data from different working condition to achieve predictive maintenance of equipment

### Basic Rotating Machine Vibration Analysis Toolbox

LEADER

Mar. 2017 - Dec. 2017

- One-click fast data transformation and simple data processing toolbox for data analysis and fault diagnosis
- Publishing the original toolbox: <https://github.com/ZhaoZhibin/Basic-Rotating-Machine-Vibration-Analysis>

### Sparse Time-Frequency Identification Method of Fast Time-Varying Vibration for Rotating Machinery

*The National Natural Science Foundation of China*

PRINCIPAL PARTICIPANTS

Mar. 2016 - PRESENT

- Sparse time-frequency method for rotating machinery vibration monitoring

## PRINCIPAL PARTICIPANTS

- Monitoring data analysis and diagnostic algorithm development

## PUBLICATIONS

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### Journal publications

- **Zhao Z**, Wang S, An B, et al. *Hierarchical Hyper-Laplacian Prior for Weak Fault Feature Enhancement*[J]. ISA Transactions, 2019 (**Early Access**).
- **Zhao Z**, Wang S, Sun C, et al. *Sparse Multiperiod Group Lasso for Bearing Multifault Diagnosis*[J]. IEEE Transactions on Instrumentation and Measurement, 2019: 1-13. (**Early Access**)
- **Zhao Z**, Qiao B, Wang S, et al. *A weighted multi-scale dictionary learning model and its applications on bearing fault diagnosis*[J]. Journal of Sound and Vibration, 2019: 429-452.
- **Zhao Z**, Wu S, Qiao B, et al. *Enhanced Sparse Period-Group Lasso for Bearing Fault Diagnosis*[J]. IEEE Transactions on Industrial Electronics, 2019, 66(3): 2143-2153.
- Wu S, Hu H, **Zhao Z**, et al. *Enhancing Sparse Decomposition Based Blade vibration Parameter Identification (in Chinese)*[J]. Chinese Journal of Mechanical Engineering, 2019. (**Early Access**)
- Qiao B, Mao Z, Liu J, **Zhao Z**, et al. *Group sparse regularization for impact force identification in time domain*[J]. Journal of Sound and Vibration, 2019: 44-63.
- Guo Y, **Zhao Z**, Sun R, et al. *Data-driven multiscale sparse representation for bearing fault diagnosis in wind turbine*[J]. Wind Energy, 2019, 22(4): 587-604. (**Cover Paper**)
- Sun C, Ma M, **Zhao Z**, et al. *Sparse Deep Stacking Network for Fault Diagnosis of Motor*[J]. IEEE Transactions on Industrial Informatics, 2018, 14(7): 3261-3270.
- Sun C, Ma M, **Zhao Z**, et al. *Deep Transfer Learning for Remaining Useful Life Prediction of Tool in Manufacturing*[J]. IEEE Transactions on Industrial Informatics, 2019, 15(4): 2416-2425.
- Guo Y, Chen X, Wang S, Sun R, **Zhao Z**. *Wind Turbine Diagnosis under Variable Speed Conditions Using a Single Sensor Based on the Synchrosqueezing Transform Method*[J]. Sensors, 2017, 17(5).
- Wang S, Chen X, Tong C, **Zhao Z**. *Matching Synchrosqueezing Wavelet Transform and Application to Aero-engine Vibration Monitoring*[J]. IEEE Transactions on Instrumentation and Measurement, 2017, 66(2): 360-372.

### Papers submitted

- **Zhao Z**, Wang S, Sun C, et al. Sparsity-assisted Fault Feature Enhancement: Algorithm-aware versus Model-aware. IEEE Transactions on Industrial Electronics, 2019 (**Under Review**).
- An B, **Zhao Z**, Wang S, et al. Sparsity-assisted Bearing Fault Diagnosis using Multiscale Period Group Lasso. ISA Transactions, 2019 (**Major Revision**).
- Wu S, **Zhao Z**, Yang Z, et al. Physical Constraints Fused Equiangular Tight Frame Method for Blade Tip Timing Sensor Arrangement. Measurement, 2019 (**Major Revision**).
- Xu W, **Zhao Z**, Sun C, et al. Multi-scale Convolutional Gated Recurrent Unit Networks for Tool Wear Prediction in Manufacturing. Mechanical Systems and Signal Processing, 2019 (**Under Review**).
- Yang L, Liu J, **Zhao Z**, et al. Spline adaptive filters based on real-time over-sampling strategy for nonlinear system identification. Applied Mathematical Modelling, 2019 (**Under Review**).
- Yang L, Liu J, **Zhao Z**, et al. Interval variable step-size spline adaptive filter for the identification of nonlinear block-oriented system. Nonlinear Dynamics, 2019 (**Under Review**).
- Li T, **Zhao Z**, Sun C, et al. Multiscale CNN for Multisensors Feature Fusion in Helical Gear Fault Detection. the 8th International Conference on Through-Life Engineering Service (TESConf 2019), 2019 (**Under Review**).
- Wu J, **Zhao Z**, Sun C, et al. ss-infoGAN for class-imbalance classification of bearing. the 8th International Conference on Through-Life Engineering Service (TESConf 2019), 2019 (**Under Review**).

### Conference publications

- Wu S, Chen X, Russhard P, Yan R, Wang S, **Zhao Z**, Tian S. Blade Tip Timing: from Raw Data to Parameters Identification[C]. 2019 IEEE International Instrumentation and Measurement Technology Conference

(I2MTC), IEEE, 2019. (**Accept**).

- Wu S, Chen X, Russhard P, Wang S, Zhai Z, **Zhao Z**. *Foreign Object Damage Diagnosis of Aero-Engine Compressor Based on Damping Averaging Built-in Matrix Method*[C]. ASME. Turbo Expo: Power for Land, Sea, and Air, Volume 1: Aircraft Engine; Fans and Blowers; Marine ():V001T01A017.
- **Zhao Z**, An B, Wang S, et al. *Bearing Fault Diagnosis Using Hyper-Laplacian Priors and Non-convex Optimization*[C]. 2018 Prognostics and System Health Management Conference (PHM-Chongqing), IEEE, 2018: 1239-1244.
- **Zhao Z**, Chen X, Wang S, et al. *Periodic overlapping group elastic net for fault diagnosis*[C]. 2018 IEEE International Instrumentation and Measurement Technology Conference (I2MTC), IEEE, 2018: 1-6.
- **Zhao Z**, Chen X, Ding B, et al. *TQWT-based multi-scale dictionary learning for rotating machinery fault diagnosis*[C]. Automation Science and Engineering (CASE), 2017 13th IEEE Conference on, 554-559.
- Wang J, Sun C, **Zhao Z**, et al. *Feature ensemble learning using stacked denoising autoencoders for induction motor fault diagnosis*[C]. Prognostics and System Health Management Conference (PHM-Harbin), 2017, 1-6.
- Wu S, Chen X, **Zhao Z**, et al. *Data-driven discriminative K-SVD for bearing fault diagnosis*[C]. Prognostics and System Health Management Conference (PHM-Harbin), 2017, 1-6.

## HONORS & AWARDS

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2018	<b>Merit Awards</b> , The Second Industrial Big Data Innovation Competition: Residual useful life prediction of machine tools	China
2018	<b>Merit Awards</b> , 2018 Global Artificial Intelligence Application Competition	Nanjing
2018	<b>On-line Top2 &amp; Final Top1</b> , Fault Prediction on Engineering Machinery Equipments Based on Machine Learning	Kesci
2016	<b>Outstanding Graduate Students</b> , Xi'an Jiaotong University	Xi'an
2014	<b>3rd Place</b> , Automatic Control Obstacle Avoidance Car Contest	Taiwan
2012, 2013, 2014, 2015	<b>Cyrus Tang Scholarship</b> , Cyrus Tang Foundation	Xi'an

## PROFESSIONAL ACTIVITIES

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### 2018 Prognostics and System Health Management Conference

Chongqing, China

ORAL PRESENTATION

Oct. 2018

- Bearing Fault Diagnosis Using Hyper-Laplacian Priors and Non-convex Optimization

### 2018 International Instrumentation and Measurement Technology Conference

Houston, TX, USA

ORAL PRESENTATION

May. 2018

- Periodic Overlapping Group Elastic Net for Fault Diagnosis

### The 13th IEEE International Conference on Automation Science and Engineering

Xi'an, China

ORAL PRESENTATION

Aug. 2017

- TQWT-based multi-scale dictionary learning for rotating machinery fault diagnosis

## SKILLS

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<b>Programming</b>	Python, Matlab, LaTeX, Pytorch, Keras
<b>Software</b>	SOLIDWORKS, ANSYS, INVENTOR, OFFICE
<b>Experiment</b>	Modal test and vibration test using LMS and HBM
<b>Languages</b>	Chinese, English