Haining ZHANG

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EDUCATION

Ph.D. School of Mechanical and Aerospace Engineering
Nanyang Technological University, Singapore (2016.07-2020.10)
Thesis: A Printing Quality Optimization Framework for Non-contact Ink Writing Techniques
Advisor: Prof. Seung Ki Moon

M.S. Transportation Information Engineering and Control
Central South University, China (2007.09-2010.07)

B.S. Electronic and Information Engineering
Central South University, China (2002.09-2006.07)

PROFESSIONAL APPOINTMENTS

Oct. 2025 - Present	Research Fellow PRISM-AI InnoCORE Research Center **Korea Advanced Institute of Science and Technology, Korea**
May. 2025 - Oct. 2025	Hong Kong RTH Fellowship (Hong Kong SAR) Advanced Computational Science Laboratory **The Hong Kong University of Science and Technology, Hong Kong**
Jan. 2024 - May. 2025	Hong Kong RTH Fellowship (Hong Kong SAR) The Centre for Advances in Reliability and Safety **The Hong Kong Polytechnic University, Hong Kong**
Jan. 2021 - Dec. 2023	Assistant Professor School of Information Engineering **Suzhou University, China**
Jan. 2020 - Oct. 2020	Research Assistant School of Mechanical and Aerospace Engineering **Nanyang Technological University, Singapore**

PROJECT EXPERIENCE

Machine Learning & Process Optimization for Additive Manufacturing

- **Anomaly Detection in FDM & AJP Processes** | *KAIST-KIMM Corporate Lab*
  - **Developed** a generalized deep learning model for real-time anomaly detection in Fused Deposition Modeling (FDM) and Aerosol Jet Printing (AJP).
  - **Enhanced** process reliability by enabling early detection of defects during fabrication, significantly reducing material waste.
- **Physics-Driven Aerosol Jet Printing Optimization** | *KIMM-SZU*
  - **Established** a physics-driven multiphysics modeling framework to optimize the Aerosol Jet Printing (AJP) process.
  - **Integrated** process simulation with experimental data to enhance printing precision and material deposition quality.
- **ML-Driven Sensor Printing for Turbine Blades** | *ST-NTU*
  - **Engineered** a machine learning-driven 3D printing process for fabricating sensors directly onto turbine blades.
  - **Enabled** real-time engine diagnostics through the integration of printed sensors, optimizing performance and safety.

Additive Manufacturing & Functional Sensor Integration

- **Metal 3D Printed High-Temp Sensors** | *KIMM*
  - **Designed** and manufactured metal 3D-printed sensors capable of withstanding high-temperature environments in turbine blades.
  - **Facilitated** real-time diagnostics and monitoring of engine conditions under extreme operating parameters.
- **Flexible Battery Printing & Optimization** | *NAMIC*
  - **Optimized** the printability of functional materials for the manufacturing of flexible 3D-printed batteries.
  - **Demonstrated** the feasibility of fully printed energy storage devices with customized form factors.
- **UAV Structural Health Monitoring System** | *ST-NTU*
  - **Designed and fabricated** dual-modal sensors (vibration/temperature) for Unmanned Aerial Vehicles (UAVs).
  - **Achieved** real-time Structural Health Monitoring (SHM) capabilities, enhancing the operational safety and longevity of UAVs.

Digital Twin & Intelligent Manufacturing Systems

- **HP-NTU Intelligent Manufacturing Framework** | *HP-NTU Corporate Lab*
  - **Orchestrated** a data-to-physics manufacturing architecture to enable smart factory capabilities through digital twin integration.
  - **Developed** a comprehensive framework connecting physical manufacturing processes with virtual models, facilitating real-time monitoring and simulation.
- **SMRT Power Transmission Monitoring System** | *NRF/SMRT*
  - **Designed** dual-mode strain-temperature sensors for real-time Structural Health Monitoring (SHM) of compressor systems.
  - **Implemented** AI-driven predictive maintenance strategies using systematic machine learning algorithms to forecast potential failures and optimize maintenance schedules.

PUBLICATIONS

Patents & Intellectual Property

1. **Zhang H.**, "Five-Axis Aerosol-Based 3D Printing Device and Method". Luxembourg Invention P atent, Granted 2024.
2. **Zhang H.**, "Intelligent Process Optimization and Real-Time Quality Monitoring for Fused Deposition Modeling via Multi-Algorithm Collaboration". Chinese Invention Patent, Granted 2025.
3. **Zhang H.**, "Real-Time Quality Monitoring and Intelligent System Drift Correction for Aerosol Jet 3D Printing." Chinese Invention Patent, Granted 2025.
4. **Zhang H.**, "Conductivity and Flexibility Enhancement of Aerosol Jet Printed Sensors by using Silver Nanoparticles Ink with Carbon Nanotubes." Technical Disclosure, Nanyang Technological University, Filed 2021.

Peer-Reviewed Journal Papers (Underline: First author, *Corresponding author, **IF**: Impact Factor)

1. **Zhang H.**, Lee P., Kim Y., Moon S,K., Yoon Y.J., Choi J.P.*. "LLM-inspired Vision Transformer Framework for Intelligent Quality Recognition in Aerosol Jet Printing". ***Engineering*.2026**; *Major Revision*. (Q1, IF: 11.6)

2. **Zhang H.***, Lee P., Kim Y., Moon S,K., Choi J.P.*. "Autonomous Printing Process Optimization and In-Situ Anomaly Detection in Fused Deposition Modeling Using an Integrated Data-Driven Approach". ***Virtual and Physical Prototyping***. **2025**; 20(1), e2545523. (Q1, IF: 10.3)

3. **Zhang H.**, Huang J.*, Zhang X.*, Wong C. "Uncertainty quantification of aerosol jet 3D printing process using non-intrusive polynomial chaos and stochastic collocation". ***Advanced Engineering Informatics***. **2025**; 1;65:103175. (Q1, IF: 9.9)

4. **Zhang H.**, Cui L., Lee P., Kim Y., Moon S,K., Choi J.P.*. AI-Driven Process Optimization Framework for Enhancing Print Quality in Aerosol Jet Printing. ***International Journal of Precision Engineering and Manufacturing-Green Technology***. **2025**; 12(3), 853-867. (Q1, IF: 4.2)

5. **Zhang H***, Cui L., Lee P., Kim Y., Moon S,K., Choi J.P.*. "Data-Driven Autonomous Printing Process Optimization and Real-Time Abnormality Identification in Aerosol Jet-Deposited Droplet Morphology". ***Virtual and Physical Prototyping***. **2024**; 19(1):e2429530. (Q1, IF: 10.3)

6. **Zhang H.**, Huang J.*, Zhang X.*, Wong C. "Autonomous optimization of process parameters and in-situ anomaly detection in aerosol jet printing by an integrated machine learning approach." ***Additive Manufacturing***. **2024**; 25;86:104208. (Q1, IF: 10.3)

7. **Zhang, H.**, Choi, J.P., Moon, S.K.*, and Ngo, T.H., "A hybrid multi-objective optimization of aerosol jet printing process via response surface methodology." ***Additive Manufacturing***. **2020**; 33: 101096. (Q1, IF: 10.3)

8. **Zhang H.**, Hong E, Chen X, Liu Z. "Machine Learning Enables Process Optimization of Aerosol Jet 3D Printing Based on the Droplet Morphology." ***ACS Applied Materials & Interfaces***. **2023**; 15(11):14532-45. (Q1, IF: 10.383)

9. **Zhang, H.**, Moon, S. K.*. "Reviews on machine learning approaches for process optimization in non-contact direct ink writing". ***ACS Applied Materials & Interfaces***. **2021**; 27;13(45):53323-45. (Q1, IF: 10.383)

10. **Zhang, H.**, Moon, S.K.*, and Ngo, T.H. "Hybrid Machine Learning Method to Determine the Optimal Operating Process Window in Aerosol Jet 3D Printing." ***ACS Applied Materials & Interfaces***. **2019**; Vol. 11, No. 19, pp. 17994-18003. (Q1, IF: 10.383)

11. **Zhang, H.**, Moon, S. K.*, and Ngo, T. H. "A knowledge transfer framework to support rapid process modeling in aerosol jet printing." ***Advanced Engineering Informatics***. **2021**; 48: 101264.（Q1, IF: 8.0）

12. **Zhang, H.**, Moon, S. K.*, and Ngo, T. H. "A multi-objective optimization framework for aerosol jet customized line width printing via small data set and prediction uncertainty." ***Journal of Materials Processing Technology***, **2020**; 116779.（Q1, IF: 6.7）

13. **Zhang H.**, Liu Z, Yin S, Xu H. "A hybrid multi-objective optimization of functional ink composition for aerosol jet 3D printing via mixture design and response surface methodology." ***Scientific Reports***. **2023**; 13(1):2513. (Q1, IF: 4.997)

14. **Zhang, H.**, Moon, S.K.*, and Ngo, T.H. "3D Printed Electronics of Non-contact Ink Writing Techniques: Status and Promise." ***International Journal of Precision Engineering and Manufacturing – Green Technology***. **2020**; Vol. 7. No. 2, pp. 511-524. (Q1, IF: 5.67)

15. **Zhang, H.**, Moon, S.K.*, Ngo, T.H., Tou, J., and Mohamed, A.B.M.Y. "Rapid process modeling of the Aerosol Jet printing based on Gaussian process regression with Latin hypercube sampling." ***International Journal of Precision Engineering and Manufacturing***. **2020**; Vol.21, No.1, pp127-136. (Q2, IF: 2.6)

16. **Zhang, H.**, Xu, H., Cui L., Pan Z., Lee P.H., Jung M.K., Choi J. P. "An Extensive Study of the Influence of Key Flow Variables on Printed Line Quality Outcomes during Aerosol Jet Printing Using Coupled Three-Dimensional Numerical Models." ***Materials***. **2024**; 17(13), 3179 (Q1, IF: 3.1)

17. **Zhang, H.**, Choi, J.P., Moon, S.K. "Conductivity and flexibility enhancement of aerosol-Jet-Printed sensors using a silver nanoparticle ink with carbon nanotubes." ***Arch. Metall. Mater***. **2024**; 69(2), 401-405. (Q3, IF: 1.0)

18. Liu Z, Liu Y, He L, Cui L, Liang N, Choi JP, **Zhang H.*** "A Comprehensive Investigation of Process Parameters and Material Properties Effects on Printed Line Quality of Aerosol Jet Printing Based on Coupled Three-dimensional Numerical Models." ***International Journal of Precision Engineering and Manufacturing-Green Technology***. **2024**; 28:1-6. (Q1, IF: 4.2)

19. Li M, Liu Z, Yin S, Choi JP, **Zhang H.*** "Comparison and identification of optimal machine learning model for rapid optimization of printed line characteristics of aerosol jet printing technology." ***International Journal of Precision Engineering and Manufacturing-Green Technology***. **2024**; 11(1):71-87. (Q1, IF: 4.2)

20. Li M., Yin S, Liu Z, **Zhang H.*** "Machine learning enables electrical resistivity modeling of printed lines in aerosol jet 3D printing." ***Scientific Reports***. **2024**; 13(1):2513. (Q1, IF: 4.997)

21. Shan X, Pan Z, Gao M, Han L, Choi JP, **Zhang H.*** "Multi-Physics Modeling of Melting-Solidification Characteristics in Laser Powder Bed Fusion Process of 316L Stainless Steel." ***Materials***. **2024**; 17(4):946. (Q1, IF: 3.1)

22. Liu Y, Yin S, Liu Z, **Zhang H.*** "A machine learning framework for process optimization in aerosol jet 3D printing." ***Flexible and Printed Electronics***. **2023**; 6;8(2):025017. (Q3, IF: 3.1)

23. Goh G.L., **Zhang H. (Co-first Author)**, Goh G.D., Yeong W.Y. and Chong T.H. "Multi-objective optimization of intense pulsed light sintering process for aerosol jet printed thin film." ***Materials Science in Additive Manufacturing***. **2022**; 1(2):10.

24. Goh, G. L., **Zhang, H.**, and Yeong, W. Y*. "3D Printing of Multilayered and Multimaterial Electronics: A Review." ***Advanced Electronic Materials***. **2021**; 2100445. (Q1)

25. Wang Bing, **Zhang H.**, Moon, S. K.*, "A Post-Treatment Method to Enhance the Property of Aerosol Jet Printed Circuit on 3D Printed Substrate". ***Materials***. **2020**; 13(24): 5602. (Q2)

26. Xu H., Liang N., Cui L., **Zhang H.**, Yang B., Jin Z.*, "Synergistic effect of interface and defect engineering of MoC/MoO2 nano dot encapsulated N-doped carbon nanoflowers for highly durable dye-sensitized solar cells," ***Journal of Colloid and Interface Science*****, 2024**; 653, 1620-1629

27. Liang N., Xu H., **Zhang H.**, Zhang Z., Wang M., Jin Z. "Enhancing Catalytic Activity in Mo2C Nanodots via Nitrogen Doping and Graphene Integration for Efficient Hydrogen Evolution under Alkaline Conditions." ***Journal of Colloid and Interface Science*****, 2025**; 684:1-9

Peer-Reviewed Conference Papers

1. **Zhang, H.**, Moon, S.K., Ngo, T.H., Tou, J., and Mohamed, A.B.M.Y., A Hybrid Machine Learning Approach for the Quality Optimization of a 3D Printed Sensor, ***IEEE International Conference on Intelligent Rail Transportation***, Paper ID:62, pp. 1-5, Singapore, 12-14 December 2018 (Indexed in IEEE EI Explorer).

2. Lim J. J. W., Kim N., Moon S. K., Choi J., & **Zhang H.** Aerosol Jet Printed Temperature Sensor for Wireless Healthcare Monitoring. InIRC-SET 2020: ***Proceedings of the 6th IRC Conference on Science, Engineering and Technology***, July 2020, Singapore (pp. 663-674). Springer.

3. Kim, N., Wei, J. L. J., Ying, J., **Zhang, H.**, Moon, S. K., & Choi, J. A customized smart medical mask for healthcare personnel. **In IEEE International Conference on Industrial Engineering and Engineering Management (IEEM**), Dec 2020 (pp. 581-585). IEEE.

4. Wong T. C. H., Jang M. K., Moon S. K., Chua Z. Y., **Zhang H.**, & Oh, H. S. A Human Centered Design Framework to Support Product-service Systems. **In 2018 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)**, Dec 2018 (pp. 545-549). IEEE.

5. Zhang, Z., Wu, X., Xu, H., Cui, L., **Zhang, H.**, & Qin, W. Link Value Estimation Based Graph Attention Network for Link Prediction in Complex Networks, **9th International Symposium on System Security, Safety, and Reliability (ISSSR)**, 2023, Italy, IEEE.

Posters and Presentations

1. **Zhang, H**. and Moon, S.K., "Process Modeling and Hybrid Multi-objective Optimization of Aerosol Jet 3d Printing," IEEE International Conference of Industrial Engineering and Engineering Management (IEEM), Macau, China, December, 15-18, 2019.

2. **Zhang, H**. and Moon, S.K., "A Multidisciplinary Optimization Method for Aerosol Jet Printing Process Parameters in Customized Sensor Design," Asia-Korea Conference on Science and Technology, Singapore, November, 21-23, 2019.

3. **Zhang, H**. and Moon, S.K., "Computational Fluid Dynamics Modeling and Uncertainty Quantification in Aerosol Jet Printing," IEEE International Conference of Industrial Engineering and Engineering Management (IEEM), Bangkok, Thailand, December, 16-19, 2018.

4. **Zhang, H**. and Moon, S.K., "Rapid Process Modeling of the Aerosol Jet Printing Based on Gaussian Process Regression," International Symposium on Precision Engineering and Sustainable Manufacturing (PRESM), Sapporo, Japan, July, 03-07, 2018.

PROFESSIONAL SERVICE

Guest Editor

- **Materials** (Impact Factor: 3.4)
  - Special Issue: *Innovative Computational and Data-Driven Strategies for Advancing Materials and Processes in Additive Manufacturing*
- **Crystals** (Impact Factor: 2.7)
  - Special Issue: *Additive Manufacturing of Alloys via Laser-Based Techniques*
  - Special Issue: *Machine Learning for Material and Process Optimization in AM*

Journal Reviewer

- **Summary:** Completed over **90** peer reviews for **18** international journals.
- **Main Contributions:** Primarily reviewed for *Additive Manufacturing*, *Journal of Manufacturing Processes*, *Virtual and Physical Prototyping*, and *Knowledge-Based Systems*.