



# Chen Lequn

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[Linkedin](#) | [Google Scholar](#) | [Research Gate](#) | [GitHub](#) | [YouTube](#) | [ORCID](#)

Advanced Remanufacturing and Technology Centre (ARTC), A\*STAR, Singapore  
Nanyang Technological University, Singapore

## RESEARCH INTEREST

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- AI-assisted in-situ process monitoring, defect detection, and closed-loop control for laser-directed energy deposition (L-DED).
- Multi-sensor data fusion, spatiotemporal deep learning.
- Robot tool-path planning for Additive Manufacturing.

## EDUCATION

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**Nanyang Technological University** Singapore

*Ph.D. in Mechanical Engineering (additive manufacturing)*

Aug 2021 - May 2024 (Expected)

- **Thesis:** Multi-Sensor Fusion For In-Situ Defect Detection And Adaptive Quality Enhancement In Laser-Directed Energy Deposition
- **Advisors:** Dr Chew Youxiang (A\*STAR ARTC), Professor Moon Seung Ki (NTU), Dr Yao Xiling (NRF Singapore, A\*STAR SIMTech), Dr Liu Kui (A\*STAR SIMTech)

**Nanyang Technological University**

*Bachelor of Engineering (Mechanical engineering)*

Singapore

Aug 2017 - Jun 2021

- **Honours (Highest Distinction):** CGPA 4.68/5.00
- **Specialisation:** Robotics and Mechatronics
- **Advisors:** Dr Yao Xiling, Professor Moon Seung Ki

**Technical University of Denmark (DTU)**

*Semester Exchange (GEM Explorer Oversea Programme)*

Copenhagen, Denmark

Jan 2019 - Jun 2019

## RESEARCH AND INDUSTRY EXPERIENCE

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**A\*STAR, Advanced Remanufacturing and Technology Centre (ARTC)**

*Research Scientist*

Singapore

April 2024 - Present

- Research on adaptive toolpath planning, in-situ monitoring, defect detection, and closed-loop control for laser-based additive manufacturing and WAAM.

**A\*STAR, Singapore Institute of Manufacturing Technology (SIMTech)**

*Research Intern & PhD research attachment*

Singapore

Aug 2019 - March 2023

- **Advisors:** Dr. Yao Xiling, Dr. Liu Kui, Dr. Chew Youxiang
- Developed a multi-sensor monitoring system integrating vision, acoustic, thermal sensors, and laser scanners for in-situ defect detection in hybrid robotic additive-subtractive manufacturing.
- Developed an in-process adaptive toolpath generation strategy for dimension deviation corrections in laser AM.

- Developed multi-sensor fusion-based digital twin with deep learning-assisted location-dependent defect detection in L-DED.
- Novel alloy composition design: machine learning-assisted surrogate modelling and multi-objective optimization of a novel Fe-Ni-Ti-Al maraging steel based on CALPHAD Simulation.
- Developed a data-driven adaptive control method tailored for modulating laser power based on melt pool size signal in the laser AM process.

### Schaeffler Hub for Advanced Research at NTU (SHARE at NTU)

R&D Engineer (Part-time)

Singapore

Jan 2020 - Dec 2020

- **Supervisors: Dr. Marcel Philip Mayer, Mr. Boon Siew Han**
- Created an application tailored for Quad robots, operationalizing a quasi-omni-directional AGV framework.
- Integrated the A\* path-finding algorithm into AGV functionalities within the Gazebo environment under the Robot Operating System (ROS).
- Researched and implemented algorithms dedicated to collision avoidance and QR code recognition aimed at refining mobile robot navigation.
- Developed a Qt GUI for streamlined communication between microprocessors and electric motor controllers.

### JOURNAL PUBLICATIONS

Current h-index: **10**. Total citations: **305** (based on **Google Scholar**).

- [1] **L. Chen**, G. Bi, X. Yao, J. Su, C. Tan, W. Feng, Y. Chew and S. K. Moon, "In-situ process monitoring and adaptive quality enhancement in laser additive manufacturing: a critical review", *Journal of Manufacturing Systems*, (Accepted), 2024
- [2] **L. Chen\*** and S. K. Moon "In-Situ Defect Detection in Laser-Directed Energy Deposition with Machine Learning and Multisensor Fusion", *Journal of Mechanical Science and Technology*, 2024
- [3] J. Su, F. Jiang, J. Teng, **L. Chen**, M. Yan, G. Requena, L-C. Zhang, Y. M. Wang, I V. Okulov, H. Zhu and C. Tan, "Recent Innovations in Laser Additive Manufacturing of Titanium Alloys", *International Journal of Extreme Manufacturing*, 2023 (IF: 14.7, Q1)
- [4] J. Su, F. Jiang, J. Teng, **L. Chen**, G. Requena, M. Yan, L-C. Zhang, Y. M. Wang, I V. Okulov, G. Bo, H. Zhu, and C. Tan, "Laser additive manufacturing of titanium alloys: process, materials and post-processing", *Rare Metals*, (Accepted), 2023 (IF: 8.8, Q1)
- [5] **L. Chen**, G. Bi, X. Yao, C. Tan, J. Su, N. P. H. Ng, Y. Chew, K. Liu and S. K. Moon, "Multisensor fusion-based digital twin for localized quality prediction in robotic laser-directed energy deposition", *Robotics and Computer-Integrated Manufacturing*, vol. 84, p. 102581, 2023. (IF: 10.4, Q1) [\[full-text\]](#)
- [6] **L. Chen**, X. Yao, C. Tan, W. He, J. Su, F. Weng, Y. Chew, N. P. H. Ng, and S. K. Moon, "In-situ crack and keyhole pore detection in laser directed energy deposition through acoustic signal and deep learning", *Additive Manufacturing*, 103547, 2023. (IF: 11, Q1) [\[arXiv\]](#)
- [7] S. K. Moon, N. P. H. Ng, **L. Chen**, and G. D. Ahn, "A novel quality inspection method for aerosol jet printed sensors through infrared imaging and machine learning", *CIRP Annals - Manufacturing Technology*, 2023 (IF: 4.1)
- [8] C. Tan, Q. Li, X. Yao, **L. Chen**, J. Su, F. L. Ng, Y. Liu, T. Yang, Y. Chew, C. T. Liu, and T. DebRoy, "Machine Learning Customized Novel Material for Energy-Efficient 4D Printing", *Advanced Science*, vol. 1, p. 93-105, 2023. (IF: 15.1, Q1) [\[Code available\]](#)

- [9] J. Lee, P.C. Chua, **L. Chen**, P. H. Ng, Y. Kim, Q. Wu, S. Jeon, J. Jung, S. Chang, S. K. Moon, "Key Enabling Technologies for Smart Factory in Automotive Industry : Status and Applications", *International Journal of Precision Engineering and Manufacturing - Smart Technology*, vol. 1, p. 93-105, 2023. **[Selected Best Paper]**
- [10] J. Su, C. Tan, F.L. Ng, F. Weng, **L. Chen**, F. Jiang, T. Jie and Y. Chew, "Additive manufacturing of novel heterostructured martensite-austenite dual-phase steel through in-situ alloying", *Materials Today Communications*, vol. 33, p. 104724, 2022. (IF: 3.8, Q2)
- [11] J. Su, **L. Chen**, C. Tan, Y. Chew, F. Weng, X. Yao, F. Jiang, J. Teng "Progress in Machine-Learning-Assisted Process Optimization and Novel Material Development in Additive Manufacturing", *Chinese Journal of Lasers*, vol. 49, no. 14, Art. no. 14, Jul. 2022.
- [12] P. Xu, X. Yao, **L. Chen**, C. Zhao, K. Liu, S.K. Moon, and G. Bi, "In-process adaptive dimension correction strategy for laser aided additive manufacturing using laser line scanning", *Journal of Materials Processing Technology*, vol. 303, p. 117544, 2022. (IF: 6.3, Q1)
- [13] **L. Chen**, X. Yao, P. Xu, S.K. Moon, and G. Bi, "Rapid surface defect identification for additive manufacturing with in-situ point cloud processing and machine learning", *Virtual and Physical Prototyping*, vol. 16, no. 1, pp. 50-67, Oct. 2020 (IF: 10.6 Q1) **[Video Demo]**
- [14] **L. Chen**, X. Yao, Y. Chew, F. Weng, S. K. Moon, and G. Bi, "Data-driven adaptive control for laser-based additive manufacturing with automatic controller tuning", *Applied Sciences*, Vol. 10, no. 22, Art. no. 22, Jan. 2020. (IF: 2.7, Q2) **[Video Demo]**

## PEER-REVIEWED CONFERENCES PROCEEDINGS

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- [1] **L. Chen\***, Y. Chew, W. Feng, and S. K. Moon, "Inference of Melt Pool Visual Characteristics in Laser Additive Manufacturing using Acoustic Signal Features and Robotic Motion Data", *2024 10th International Conference on Control, Automation and Robotics (ICCAR 2024)*, Singapore, (Accepted)
- [2] **L. Chen**, N. P. H. Ng, J. Jung and S. K. Moon, "Additive Manufacturing for Automotive Industry: Status, Challenges and Future Perspectives", *2023 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Singapore, 19 - 23 December, 2023.
- [3] Y. Xie, **L. Chen\***, X. Yao, W. Feng and S. K. Moon, "Adaptive Voxelization and Material-dependent Process Parameter Assignment for Multi-Material Additive Manufacturing", *2023 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Singapore, 19 - 23 December, 2023. **(Shortlisted Best paper award)**
- [4] **L. Chen\*** and S. K. Moon "In-Situ Defect Detection in Laser-Directed Energy Deposition with Machine Learning and Multisensor Fusion. *2023 2nd International Conference on Design for 3D Printing (ICD3DP)*, Jeju, Korea, 18 - 21 Oct, 2023. **(Best paper award)**
- [5] **L. Chen**, X. Yao, W. Feng, Y. Chew, and S. K. Moon, "Multimodal Sensor Fusion for Real-Time Location-Dependent Defect Detection in Laser-Directed Energy Deposition", *ASME 2023 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC-CIE2023)*, Boston, USA, 20 - 23 August, 2023. **[arXiv] [Video Demo]**
- [6] **L. Chen**, X. Yao, K. Liu, C. Tan, and S. K. Moon, "Multisensor fusion-based digital twin in additive manufacturing for in-situ quality monitoring and defect correction", *24th International Conference on Engineering Design (ICED 2023)*, 24 - 28 July, 2023, Bordeaux, France. **[arXiv] [Video Demo]**
- [7] **L. Chen**, X. Yao, P. Xu, S. K. Moon, W. Zhou, and G. Bi, "In-Process Sensing, Monitoring and Adaptive Control for Intelligent Laser-Aided Additive Manufacturing", *Transactions on Intelligent Welding Manufacturing (TRINWM)*.

- [8] **L. Chen**, X. Yao, N. P. H. Ng, and S. K. Moon, "In-situ melt pool monitoring of laser aided additive manufacturing using infrared thermal imaging", *2022 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Kuala Lumpur, Malaysia, 7 December - 10 December 2022.
- [9] **L. Chen**, X. Yao, and S. K. Moon, "Toolpath design for in-process surface defect correction in hybrid additive-subtractive manufacturing", *2022 International Conference on Design for 3D Printing*, Singapore, 22 Sep - 23 Sep 2022.
- [10] **L. Chen**, X. Yao, and S.K. Moon, "In-situ acoustic monitoring of direct energy deposition process with deep learning-assisted signal denoising", *Materials Today Proceedings, The 1st International Conference on Additive Manufacturing for a Better World*, Singapore, 23 August - 25 August 2022. **(Best paper award)**
- [11] **L. Chen**, X. Yao, P Xu, S.K. Moon, and G. Bi, "Surface Monitoring for Additive Manufacturing with in-situ Point Cloud Processing", *IEEE, The 6th International Conference on Control, Automation and Robotics (ICCAR)*, Singapore, April 20-23, 2020
- [12] P Xu, X. Yao, **L. Chen**, K. Liu and G. Bi, "Heuristic Kinematics of a Redundant Robot-Positioner System for Additive Manufacturing", *IEEE, The 6th International Conference on Control, Automation and Robotics (ICCAR)*, Singapore, April 20-23, 2020

## INVENTIONS

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- [1] **Technical disclosure**: "PropelPath: High-Speed Directed Energy Deposition Toolpath Strategy for Propeller Manufacturing with Complex Geometries", **1<sup>st</sup> inventor**
- [2] **Technical disclosure**: "An Acoustic-based In-Situ Monitoring Platform for Real-Time Process Monitoring and Defect Detection in Laser-Directed Energy Deposition", **1<sup>st</sup> inventor**
- [3] **Technical disclosure**: "A method for laser power closed loop feedback control with robot motion monitoring during DED process via optical sensor and infrared thermal measurement"
- [4] **Technical disclosure**: "Integrated Multi-sensor Fusion and Machine Learning Platform for Localized Defect Detection in Laser-Directed Energy Deposition", **1<sup>st</sup> inventor**

## RELEVANT RESEARCH GRANTS

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- **[Role: Team Member]**: AI-driven Detection of Pore Formation in Aluminum Alloy Laser Wire Directed Energy Deposition (LW-DED), funded by Mitsubishi Electrical, S\$50,000, 2024.
- **[Role: PhD Student]**: Manufacturing of Multi-material net-shape parts with heterogeneous properties, A\*STAR industry Alignment Fund - Pre-positioning (IAF-PP). (Co-)PI: Dr Chew Youxiang, Dr Feng Wenhe, S\$13, 000,000, 2023 - 2026.
- **[Role: PhD Student]**: Demonstration of an intelligent DED system for reducing process time, funded by AM Solution and collaboration with Korea Institute of Machinery & Materials (KIMM). PI: Prof Moon Seung Ki, S\$90,000, 2023 - 2024.
- **[Role: PhD Student]**: Customized Design and 3D Printing Process Optimization for Electric Vehicles (9/2021-8/2022), funded by Hyundai Motor Company (Kia Corporation), PI: Prof. Moon Seung Ki, S\$234,000, 2021 - 2024.
- **[Role: PhD Student]**: Online self-adaptation of additive-subtractive hybrid manufacturing, A\*STAR CDF grant. PI: Dr Yao Xiling. S\$ 250,000, 2021 - 2024.
- **[Role: PhD student]** Novel Inspection, Testing, and Operationalization for Aerospace Industry, Singapore Centre for 3D Printing, funded by National Research Foundation (NRF), Singapore. PI: Prof Moon Seung Ki. S\$2,080,000, 2014 - 2024
- **[Role: Undergraduate research student]**: Machine Learning Platform for Manufacturing Equipment and Solutions, A\*ccelerate GAP grant, SIMTech. (Co-)PI: Dr. Bi Guijun, Dr Yao Xiling. S\$90,000, 2018 - 2020

## SCHOLARSHIP AND AWARD

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- **Best Paper Award:** The 2nd International Conference on Design for 3D Printing, 2023
- **ASME 2023 Hackathon First Place - (\$1400):** Autodesk Problem: Automating Material Selection for Product Design). 34 Participants from 18 institutions, including Purdue University, MIT, Boston University, Texas A&M, UT Austin, Northwestern, McGill University, etc., 2023. [Code]
- **Best Paper Award - (\$1000):** International Conference of Additive Manufacturing for a Better World, 2022
- **The Global Undergraduate Awards:** Highly Commended in Engineering Category, 2021
- **A\*STAR Graduate Scholarship (AGS, PhD) - (\$400,000.00):** 2021 - 2025
- **Certificate of Distinction for Professional Internship:** 2021
- **NTU Journal Publication Award (Q1) - (\$1,000.00):** 2021
- **NTU Journal Publication Award (Q2) - (\$800.00):** 2021
- **NTU URECA Undergraduate Research Excellence Award (\$300.00):** 2020
- **The Global Undergraduate Awards:** Highly Commended Award in Engineering Category, 2020
- **Dean's List (AY2018-AY2019):** School of Mechanical and Aerospace Engineering, NTU
- **NTU President Research scholar (Merit):** 2018-2019, (**Distinction**): 2019-2020
- **3<sup>rd</sup> place in DTU Robocup Challenge Competition:** 2019
- **Science and Engineering Undergraduate Scholarship (SM2 Scholarship, Singapore Ministry of Education) - (\$255,000.00):** 2016-2021

## INVITED TALKS

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- Chen, L. "AI-driven defect detection in laser-based Additive Manufacturing". 10th Asia-Korea conference (AKC), 26 Nov, 2022.

## TEACHING/SUPERVISING EXPERIENCE

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- **Internship Mentor (ARTC):** Development of in-process adaptive toolpath generation methods for hybrid AM systems. Student Name: POMMIAH SIVAKUMAR JEEVADITHYAN, Jan 2024 - Nov 2024
- **Internship Mentor (ARTC):** Development of real-time closed-loop control software for hybrid laser AM systems. Student Name: Weng Ningjing, Jan 2024 - Aug 2024
- **Undergraduate Research Experience on Campus (URECA) Project:** Digital Twin-enabled Part Quality Investigation for Laser-Aided Additive Manufacturing. Student: Kim Jungyeon (**Now pursuing PhD study at NTU**), Aug 2022 - May 2024
- **Undergraduate Research Experience on Campus (URECA) Project:** Advanced Multi-Material Modelling for Toolpath Generation and Graded Component Fabrication in Additive Manufacturing. Student: Xie Yuxuan (**Now pursuing PhD study at NUS, under A\*STAR Scholarship**), Aug 2022 - May 2024
- **Undergraduate Research Experience on Campus (URECA) Project:** Acoustic-based in-situ monitoring for laser-aided additive manufacturing. Student: Toh Jia Hao, Aug 2022 - May 2023
- **Undergraduate Final Year Project:** Task and Data Sharing in Cloud Robotics: Dual Robot Coordination in Robot Operating System. Student: Ng Jia Jie, Aug 2022 - May 2023
- **Undergraduate Final Year Project:** Point cloud processing and toolpath generation for robotic 3D printing. Student: Goh Zhi Yong, Aug 2022 - May 2023
- **Undergraduate Final Year Project:** Thermal image analysis for in-situ monitoring of laser-aided additive manufacturing. Student: Benjamin Ong Jin Rui, Aug 2021 - May 2022
- **Lab Teaching Assistant at SIMTech:** *SGUnited Training Courses - Lab practice for laser aided additive manufacturing.* 2020 - 2021

## PROFESSIONAL SERVICE

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### Professional Membership

- **Institute of Electrical and Electronics Engineers (IEEE):** *Student Member* (Nov 2022 - Present)
- **American Society of Mechanical Engineers (ASME):** *Student Member* (Nov 2022 - Present)

### Volunteer

- **IEEM 2022 conference:** *Student Helper*, 2022
- **IEEM 2023 conference:** *Student Helper*, 2023

### Journal Reviewer

- Additive Manufacturing (Q1)
- Virtual and Physical Prototyping (Q1)
- Journal of Manufacturing Process (Q1)
- Engineering Applications of Artificial Intelligence (Q1)
- Computers in Industry (Q1)
- Scientific Reports (Q1)
- Scientific Programming
- Heliyon
- Applied Artificial Intelligence
- Digital Twins
- Computational Materials Science

### Conference

- ASME IDETC-CIE 2024

## PRESS COVERAGE

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- **NTU MAE News:** "MAE PhD Student - Chen Lequn won the first place in American Society of Mechanical Engineers (ASME), Computer and Information in Engineering (CIE) 2023 Hackathon" 2023
- **NTU MAE News:** "MAE student - PhD student Chen Lequn wins Best Paper award at International Conference of Additive Manufacturing" 2022
- **A\*STAR Manufacturing Letters:** "Hybrid Laser aided additive manufacturing technology platform" 2021
- **A\*STAR Research:** "Finding flaws fast" 2021

## LANGUAGES

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- **Chinese (Mandarin):** Native
- **English:** Full professional proficiency

## SKILLS

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- **Programming:** Most proficient in Python, C++, Familiar with C, Assembly
- **Robotics:** Robot Operating System (ROS), ROS2, ABB RAPID, Kuka KRL, MoveIt, Gazebo
- **Machine Learning & Deep Learning:** Scikit-learn, Keras, tensorflow, PyTorch, OpenCV, PCL library
- **Others:** LaTeX, Maple, MATLAB & Simulink



## REFERENCES

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- **Moon Seung Ki**  
Associate Professor  
Assistant Chair (Research)  
School of Mechanical and Aerospace Engineering  
Nanyang Technological University (NTU Singapore)  
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- **Liu Kui**  
Senior Research Scientist, Section Manager, Precision Machining  
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