

Sheng Yang BSc, MSc, PhD

Postdoctoral Fellow in Additive Manufacturing and Design Innovation
McGill University, Montreal, Canada

Date of Birth: February 24th 1990
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Summary

Sheng Yang is an experienced research fellow with three year's teaching experience in computer-aided manufacturing, manufacturing processes, and product design. He has intensive collaborations with industrial partners from aerospace (e.g. Pratt & Whitney, Precision ADM, and Bell Helicopter), automobiles (e.g. VeloMetro), and engineering software (e.g. Autodesk and PTC) sectors. Sheng currently works as a postdoctoral fellow in the Additive Design and Manufacturing Laboratory (ADML) at McGill University with special focus on manufacturability evaluation of aerospace components fabricated by laser powder bed fusion additive manufacturing process and developing pipelines for AM accessibility improvement for non-AM expert. Before this position, he worked as an ACU research fellow at the Brunel University London on the emerging challenge of 3D printing plastics waste management.

Sheng also assisted the management of the ADML research group as well as the supervision of MSc and junior PhD students. He has contributed to three funded research proposals with one being the principle investigators. To date, Sheng has authorized 17 peer-reviewed papers in recognized journals and conference proceedings with over 400 citations since 2015. He received one *DFMLC Best Paper Award* from ASME IDETC/CIE 2018 and one *Featured Article* recognition from J. Mech. Des. Other major awards he received include *ACU Blue Charter Fellowship* in 2019, *Chinese Government Award for Outstanding Self-Financed Students Abroad* in 2017, and *McGill Engineering Doctoral Award (MEDA)* in 2014. He has served as a reviewer for J. Mech. Des. and the Int. J. Adv. Manuf. Tech.

Research Interests

- Additive Manufacturing (*incl. DfAM, 4D printing, and reprogrammable matter*)
- Machine Learning-Driven Product Design & Advanced Manufacturing
- Digital Twin-Based Complex System Optimization
- Mass Customization
- Sustainable Design & Manufacturing
- CAD/CAM

Education

- **PhD, Mechanical Engineering, McGill University, 2019**

Title: Rules and Methods for Exploring and Utilizing AM-Enabled Part Consolidation Potentials in Product Redesign

- **MSc, Aerospace Engineering, Northwestern Polytechnical University, 2014**

Title: Stability Analysis and Optimization of Mixed Machining Production Line Based on Complex Network Theory

- **BSc, Aircraft Manufacturing Engineering, Northwestern Polytechnical University, 2011**

Experience

Postdoctoral Fellow

2019.04-Present

Supervisor: Prof. Fiona Zhao and Prof. Mathieu Brochu

Affiliation: McGill University, Department of Mechanical Engineering, Canada

- Research into the manufacturability evaluation of metallic components fabricated by laser powder bed fusion additive manufacturing process via feature recognition and machine learning techniques.
- Research into the knowledge modeling of additive manufacturing and its dissemination to non-AM experts.

ACU Blue Charter Fellow

2019.01-2019.03

Supervisor: Prof. David Harrison

Affiliation: Brunel University London, Design School, Institute for Materials and Manufacturing, UK

- Research into the process-specific 3D printing waste estimation and flow control, and its intervention strategies in the full value chain. In collaboration with Loughborough University, UK.

Research Assistant

2014.05-2018.12

Supervisor: Prof. Fiona Zhao

Affiliation: McGill University, Department of Mechanical Engineering, Canada

- Research into the rules and methods for supporting DfAM, especially the part consolidation potentials.
- Research into the correlation between design creativity and AM knowledge and its implications in design.
- Research into the sustainability analysis of additively manufactured parts throughout its life cycle.

Teaching Activities

Guest Lecturer

2018.09-2018.12

Affiliation: McGill University, Canada

Course: Principles of Manufacturing

- Teaching the lecture of design for additive manufacturing with a focus on the design freedoms and constraints of additive manufacturing processes as well as the tutorial of topology optimization software.

Teaching Assistant

2015.09-2017.12

Affiliation: McGill University, Canada

Course: Principles of Manufacturing

- Initialized the tutorial materials including 3D printing lab, MaterCAM tutorial, and CNC milling lab.
- Led the tutorial and lab sessions for over 90 junior-level students in 5 consecutive semesters.
- Contributed to developing a new course for an undergraduate course - Product Conceptual Design.

Contributed Research Proposals

Closing-the-Loop Solutions for Reducing Plastics Waste in Additive Manufacturing

Source: McGill Sustainability Systems Initiative (2019). Not Funded

Amount: \$50,000

Co-PI: Sheng Yang

Role: Drafted the proposal

Elevated Plastics Waste Management in Additive Manufacturing

Source: ACU Blue Chapter Fellowship (2019.01-2019.03, UK). \$17K, Funded.

PI: Sheng Yang

Role: Drafted the proposal and in collaboration with Prof. David Harrison (Brunel University London, UK)

Methods for Embracing AM-Enabled Part Consolidation Potentials in Transportation Sectors

Source: NSERC Collaborative Research and Development Grants (2018-2019, Canada). \$45K, Funded.

PI: Prof. Fiona Zhao

Role: Drafted the proposal and being the main investigator

Function-driven design and simulation methods for hierarchical multi-material structures fabricated via additive manufacturing processes

Source: NSERC Discovery Grant (2018-2023) + DAS Award (2018-2021), \$350K, Funded.

PI: Prof. Fiona Zhao

Role: Developed foundational technology and contributed data

Publications

Book chapters

- (1) Tang, Y., **Yang, S.**, and Zhao, Y. F. (2016), "Sustainable Design for Additive Manufacturing Through Functionality Integration and Part Consolidation," Handbook of Sustainability in Additive Manufacturing: Volume 1, S. S. Muthu, and M. M. Savalani, eds., Springer Singapore, Singapore, pp. 101-144. [PDF](#)

Journal papers

- (1) **Yang, S.**, Page, T., Zhang, Y., & Zhao, Y. F. (2020) Towards an automated decision support system for the identification of additive manufacturing part candidates. *Journal of Intelligent Manufacturing*. <https://doi.org/10.1007/s10845-020-01545-6>. [PDF](#)
- (2) **Yang, S.**, Min, W., Ghibaudo, J. & Zhao, Y. F. (2019). Understanding the sustainability potential of part consolidation design supported by additive manufacturing. *Journal of cleaner production*. 232, 722-738. [PDF](#)
- (3) **Yang, S.**, Page, T., & Zhao, Y. F. (2019). Understanding the role of additive manufacturing knowledge in stimulating design innovation for novice designers. *Journal of mechanical design*, 141(2), 021703. (DFMLC Best Paper in ASME IDETC/CIE 2018). [PDF](#)
- (4) **Yang, S.**, Santoro, F., Sulthan, M., & Zhao, Y.F. (2019). A numerical-based part consolidation candidate detection approach with modularization considerations. *Research in engineering design*, pp.63-83. [PDF](#)
- (5) **Yang, S.**, & Zhao, Y. F. (2018). Additive manufacturing-enabled part count reduction: a lifecycle perspective. *Journal of mechanical design*, 140(3), 031702. (Featured article in JMD). [PDF](#) [Featured Article](#)

- (6) **Yang, S.**, Santoro, F., & Zhao, Y. F. (2018). Towards a numerical approach of finding candidates for additive manufacturing-enabled part consolidation. *Journal of mechanical design*, 140(4), 041701. [PDF](#)
- (7) **Yang, S.**, Tang, Y., & Zhao, Y. F. (2015). A new part consolidation method to embrace the design freedom of additive manufacturing. *Journal of Manufacturing Processes*, 20, 444-449. (Citation 84) [PDF](#)
- (8) **Yang, S.**, & Zhao, Y. F. (2015). Additive manufacturing-enabled design theory and methodology: a critical review. *The International Journal of Advanced Manufacturing Technology*, 80(1-4), 327-342. (Citation 204) [PDF](#)
- (9) **Yang, S.**, Li, S., Chen, B., & Yang, T. (2013). Stability analysis of mixed production lines based on process routes optimization. *Computer Integrated Manufacturing Systems*, 19 (10), 2424-2431 (published in Chinese).

Journal papers under review

- (1) Zhang, Y., **Yang, S.**, Dong, G., & Zhao, Y. F. (2020) Machine Learning assisted Manufacturability Prediction System for Laser-based Powder Bed Fusion Process. *Journal of Intelligent Manufacturing*. Under first review.
- (2) Zhang, Y., **Yang, S.**, & Zhao, Y. F. (2020) Manufacturability Analysis of Metal Laser-based Powder Bed Fusion Additive Manufacturing Process-A Survey. *Journal of Manufacturing Systems*. Under first review.

Peer-reviewed conference papers

- (1) Page, T, **Yang, S.**, Zhao, Y. F. (2019). Automated Candidate Detection for Additive Manufacturing: A Framework Proposal. *The 22nd International Conference on Engineering Design (ICED 2019)*, PP:679-688. [PDF](#)
- (2) Min, W.B., **Yang, S.**, Zhang, Y., Zhao, Y. F. (2019). A Proposed Design Approach for Metal Additive Manufacturing Processes with Elevated Sustainability. *Proceedings of the ASME 2019 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. [Accepted.](#)
- (3) Zhang, Y., Dong, G.Y., **Yang, S.**, Zhao, Y. F. (2019). Machine Learning Assisted Prediction of the Manufacturability of Laser-Based Powder Bed Fusion Process. *Proceedings of the ASME 2019 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. [Accepted.](#)
- (4) **Yang, S.**, Page, T., & Zhao, Y. F. (2018). Understanding the role of additive manufacturing knowledge in stimulating design innovation for novice designers. In *ASME 2018 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. Quebec City, QC, Canada, August 26-29. (DFMLC Best Paper Award, fast track to JMD) [PDF](#)
- (5) **Yang, S.**, Talekar, T., Sulthan, M. A., & Zhao, Y. F. (2017). A Generic Sustainability Assessment Model towards Consolidated Parts Fabricated by Additive Manufacturing Process. *Procedia manufacturing*, 10, 831-844. [PDF](#)
- (6) **Yang, S.**, Tang, Y., & Zhao, Y. F. (2016). Assembly-level design for additive manufacturing: issues and benchmark. In *ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. Charlotte, North Carolina, August 21-24. pp. V02AT03A028. [PDF](#)
- (7) **Yang, S.**, & Zhao, F. Y. (2016). Conceptual design for assembly in the context of additive manufacturing. *27th Annual International Solid Freeform Fabrication Symposium at Austin*, 4-8. [PDF](#)
- (8) Tang, Y., **Yang, S.**, & Zhao, Y. F. (2016). Design Method for Conformal Lattice-Skin Structure Fabricated by AM Technologies. In *ASME 2016 International Design Engineering Technical Conferences and Computers*

and Information in Engineering Conference. Charlotte, North Carolina, Auguste 21-24. pp. V01AT02A037. [PDF](#)

- (9) **Yang, S.,** Tang, Y., & Zhao, Y. F. (2015). A new part consolidation method to embrace the design freedom of additive manufacturing. *43 NAMRI/SME North American Manufacturing Research Conference*. Charlotte, North Carolina, Jun 8-12, 2015. (**Fast track to Journal of Manufacturing Processes**). [PDF](#)

Invited Talks & Conference Presentation

- “***Design, Creativity, and Sustainability Study of Additive Manufacturing***”. Invited by Imperial College London (Dr. Connor Myant), Loughborough University (Dr. Patrick Pradel), and Brunel University London (Dr. Eujin Pei) (2019.02), UK
- “***Understanding the role of additive manufacturing knowledge in stimulating design innovation for novice designers***”. Presented at IDETC/CIE 2018, Quebec City, QC, Canada
- “***A Generic Sustainability Assessment Model towards Consolidated Parts Fabricated by Additive Manufacturing Process***”. Presented at NAMRC 2017, Los Angeles, CA, USA
- “***Assembly-level design for additive manufacturing: issues and benchmark***”. Presented at IDETC/CIE 2016, Charlotte, NC, USA
- “***Conceptual design for assembly in the context of additive manufacturing***”. Presented at SFF 2016, Austin, TX, USA
- “***A new part consolidation method to embrace the design freedom of additive manufacturing***”. Presented at NAMRC 2015, Charlotte, NC, USA

Awards & Honors

- **ACU Blue Charter Fellowship** (2019). Awarded to only 35 fellows by the Association of Commonwealth Universities globally to support world-class research in marine plastics.
- **DFMLC Best Paper Award** in IDETC/CIE 2018 conference (2018).
- **McGill Engineering Doctoral Awards (MEDA)** (2014-2017). Full scholarship to support tuition & stipend for three years.
- **Chinese Government Award for Outstanding Self-Financed Students Abroad** (2017). Awarded to 500 nominees globally in all fields with research excellence by the Chinese Ministry of Education.
- **Graduate Research Enhancement and Travel Award (GREAT Award)** (2017). Awarded by McGill Faculty of Engineering to support travelling cost of attending international conferences.
- **MIAE HQP (High-Quality Professionals) Travel Award** (2015). Awarded by McGill Institute of Aerospace Engineering to support high-quality research in aerospace field.
- **National Scholarship**, Northwestern Polytechnical University (2013). Highly prestigious recognition of academic achievement in the Chinese education system (top 1/200).

Current Professional Activities

- Reviewer, Journal of Mechanical Design
- Reviewer, Journal of Manufacturing Science and Engineering
- Reviewer, The International Journal of Advanced Manufacturing Technology

- Reviewer, Computer-Aided Design and Applications
- Reviewer, ASME IDETC/CIE conference reviewer
- Reviewer, ASME NAMRC/MSEC conference reviewer

Students Supervision

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| • Mr. Wenbo Min, ADML Lab, Master student, McGill University | 2018.01-2019.08 |
| • Mr. Thomas Page, ADML Lab, Master student, McGill University | 2017.09-2019.06 |
| • Mr. Julian Ghibaudo, Master research intern from Arts et Métiers Paristech | 2018.06-2018.08 |
| • Mr. Florian Santoro, Master research intern from UTBM France | 2017.02-2017.08 |
| • Ms. Tanushree Talekar, ADML Lab, Master student, McGill University | 2016.09-2017.08 |
| • Mr. Mohamed A. Sulthan, ADML Lab, Master student, McGill University | 2016.09-2017.08 |

Completed Projects

Theme I: Design for Additive Manufacturing

Manufacturability Assessment of Aerospace Parts Fabricated by Laser Powder Bed Fusion (LPBF)

Source: NSERC CRD, Canada (2019.04-Present)

- To establish a general framework for manufacturability assessment for LPBF including geometric completeness, defect population, and local mechanical properties.
- To build tools for predicting the manufacturability of a given model (.stl) by combining feature recognition and machine learning techniques.

Additive Manufacturing Knowledge (AMK) Modeling and Accessibility Improvement

Source: NSERC Discovery Grant, Canada (2018.07-2018.12)

- Investigated the effects of AMK on design creativity of novice designers based on experimental workshops.
- Developed a set of candidacy rules for AM suitability from economic and technical perspectives.
- Constructed a labelled training database and applied multiple classification algorithms for candidate search.

Rules and Methods for Exploring and Utilizing Part Consolidation AM Potentials

Source: NSERC Discovery Grant, Canada (2014.05-2018.05)

- Developed a new set of rules and principles to support the identification of part candidates for consolidation.
- Composed a new embodiment design method to transmit assembly design to consolidated design.
- Built a CAD tool – “ConsolidDesign” in Rhino to support semi-automatic part consolidation redesign.

Bumper Design with Lattice Foam Infill for Crashworthiness

Source: Velometro Mobility Inc. Vancouver, Canada (2015.06-2015.12)

- Designed a new configuration for the bumper system of a new electric-pedal tricycle (speed up to 40Km/h).
- Optimized the energy-absorbing tubes by varying the cross-section shapes with desired crashing behavior.
- Investigated novel lattice infill foam to improve high-speed crashworthiness performance.

Theme II: Sustainable Design & Manufacturing

Investigation of Plastics Waste in Additive Manufacturing

Source: ACU Blue Charter Fellowship, UK (2019.01-2019.03)

- Establishing a data estimation model for 3D printing (3DP) plastics consumption and waste in UK
- Investigating the waste control flow of 3DP plastics waste produced from various polymeric additive manufacturing processes including FDM, SLS, SLA, and Polyjet.

- Synthesizing an intervention roadmap for reducing, reusing, and recycling 3DP plastics waste.

Evaluation and Improvement of Environmental Performance of AM-Fabricated Parts

Source: NSERC Discovery Grant, Canada (2017.12-2018.11)

- Developed a comparative evaluation framework of lifecycle environmental impacts for additive and subtractive manufacturing methods.
- Investigated the profitable margins of consolidated parts compared to its assembly alternative to support sustainable design.

Theme III: Complex System Modeling & Optimization

Manufacturing system failure risk prediction and optimization

Source: Xi'an Aero-Engine manufacturing Co. Ltd, China (2011.09-2014.03)

- Evaluate the robustness of a department-level manufacturing system which is comprised of multiple product lines; optimize the process planning to improve machine utilization rate and reduce potential failure.
- Estimate machining hours by using machine learning algorithms based on past instances with features.

Service

- Lab Tour guide of 3D printing labs at McGill for high school girls, 2015-2017.
- Summer Camp tutor for middle school students from underdeveloped area, 2008-2009

Selected Training

- **Hypermesh and Optistruct** (by Altair Canada).
- **Conventional lathe and milling machine operation** (by Dawson College)
- **Reverse engineering with Faro arm and Geomagics** (by Faro Technology)
- **Tormach CNC router and machine** (2.5D milling)
- **First Aid Training** (By CNESST Quebec)
- **Take-off weight estimation and fuselage layout design** (by Bombardier Aviation)

Professional Memberships

- **ASME student member**
- **McGill Sustainability Systems Initiative (MSSI)**