

# Wei (Wayne) Chen

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<b>ACADEMIC APPOINTMENTS</b>	<b>Assistant Professor, Texas A&amp;M University</b> J. Mike Walker '66 Department of Mechanical Engineering College Station, Texas	August 2023 – Present
<b>EDUCATION</b>	<b>University of Maryland</b> , College Park, Maryland, USA Ph.D., Mechanical Engineering Informatics for Design, Engineering And Learning (IDEAL) Lab	Aug 2015 – Aug 2019
	<b>Chongqing University</b> , Chongqing, China M.S., Mechanical Engineering B.S., Mechanical Engineering	Sep 2012 – Jun 2015 Sep 2008 – Jun 2012
<b>PROFESSIONAL EXPERIENCE</b>	<b>Postdoctoral Scholar, Northwestern University</b> Integrated DEsign Automation Laboratory (IDEAL) Evanston, Illinois	Apr 2021 – July 2023
	<b>Research Scientist, Siemens</b> Design & Simulation Systems Group Princeton, New Jersey	Sep 2019 – Mar 2021
<b>HONORS &amp; AWARDS</b>	ASME Journal of Mechanical Design Reviewer of the Year Award (Feb 2023)  ASME's Design Engineering Division Design Automation Committee Best Paper Award (Aug 2022) Doksoo Lee, Yu-Chin Chan, <b>Wei (Wayne) Chen</b> , Liwei Wang, Wei Chen "T-METASET: Task-Aware Generation of Metamaterial Datasets by Diversity-Based Active Learning"  2021 Journal of Mechanical Design Editors' Choice Honorable Mention (Jul 2022) <b>Wei (Wayne) Chen</b> and Faez Ahmed "PaDGAN: Learning to Generate High-Quality Novel Designs"	
<b>SELECTED PUBLICATIONS</b>	<b>Journal</b> (* indicates equal contributions) 16. Lee, D.*, <b>Chen, W.*</b> , Wang, L.*, Chan, Y. C., & Chen, W. (2023). Data-Driven Design for Metamaterials and Multiscale Systems: A Review. <i>Advanced Materials</i> , 2305254. 15. Zhang, H., <b>Chen, W.</b> , Rondinelli, J. M., & Chen, W. (2023). ET-AL: Entropy-targeted active learning for bias mitigation in materials data. <i>Applied Physics Reviews</i> , 10(2), 021403. 14. <b>Chen, W.</b> , Lee, D., Balogun, O., & Chen, W. (2023). GAN-DUF: Hierarchical Deep Generative Models for Design Under Free-Form Geometric Uncertainty. <i>Journal of Mechanical Design</i> , 145(1), 011703. 13. Lee, D., Chan, Y., <b>Chen, W.</b> , Wang, L., van Beek, A., & Chen, W. (2023). t-METASET: Task-Aware Acquisition of Metamaterial Datasets through Diversity-based Active Learning. <i>Journal of Mechanical Design</i> , 145(3), 031704. 12. Zhang, H., <b>Chen, W.</b> , Iyer, A., Apley, D. W., & Chen, W. (2022). Uncertainty-Aware Mixed-Variable Machine Learning for Materials Design. <i>Scientific Reports</i> , 12(1), 19760. 11. Wang, J., <b>Chen, W.</b> , Da, D., Fuge, M., & Rai, R. (2022). IH-GAN: A Conditional Generative Model for Implicit Surface-Based Inverse Design of Cellular Structures. <i>Computer Methods in Applied Mechanics and Engineering</i> , 396, 115060. doi:10.1016/j.cma.2022.115060.	

10. Heyrani Nobari, A., **Chen, W.**, & Ahmed, F. (2021). RANGE-GAN: Design Synthesis Under Constraints Using Conditional Generative Adversarial Networks. *Journal of Mechanical Design*, 144(2). doi:10.1115/1.4052442.
9. Chen, Q., Wang, J., Pope, P., **Chen, W.**, & Fuge, M. (2021). Inverse Design of 2D Airfoils using Conditional Generative Models and Surrogate Log-Likelihoods. *Journal of Mechanical Design*, 144(2). doi:10.1115/1.4052846.
8. **Chen, W.**, & Ahmed, F. (2021). MO-PaDGAN: Reparameterizing Engineering Designs for Augmented Multi-objective Optimization. *Applied Soft Computing*, 113, 107909. doi:10.1016/j.asoc.2021.107909.
7. **Chen, W.** & Ahmed, F. (2020). PaDGAN: Learning to Generate High-Quality Novel Designs. *Journal of Mechanical Design*, 143(3). doi:10.1115/1.4048626.
6. **Chen, W.**, Chiu, K., & Fuge, M. (2020). Aerodynamic design optimization and shape exploration using generative adversarial networks. *AIAA Journal*, 58(11), 4723-4735. doi:10.2514/1.J059317.
5. **Chen, W.** & Fuge, M. (2019). Synthesizing designs with interpart dependencies using hierarchical generative adversarial networks. *Journal of Mechanical Design*, 141(11), 111403. doi:10.1115/1.4044076.
4. **Chen, W.** & Fuge, M. (2018). Active expansion sampling for learning feasible domains in an unbounded input space. *Structural and Multidisciplinary Optimization*, 57(3), 925-945. doi:10.1007/s00158-017-1894-y.
3. **Chen, W.** & Fuge, M. (2017). Beyond the known: Detecting novel feasible domains over an unbounded design space. *Journal of Mechanical Design*, 139(11), 111405. doi:10.1115/1.4037306.
2. **Chen, W.**, Fuge, M., & Chazan, J. (2017). Design manifolds capture the intrinsic complexity and dimension of design spaces. *Journal of Mechanical Design*, 139(5), 051102. doi:10.1115/1.4036134.
1. Luo, J., **Chen, W.**, & Fu, G. (2014). Hybrid-heat effects on electrical-current aided friction stir welding of steel, and Al and Mg alloys. *Journal of Materials Processing Technology*, 214(12), 3002-3012. doi:10.1016/j.jmatprotec.2014.07.005.

#### **Patent**

1. **Chen, W.** & Ramamurthy, A. (2021). Deep neural networks for synthesis and optimization of smooth surfaced 3D objects (International Publication Number WO2021247662A1). World Intellectual Property Organization.

#### **Conference (Full Length, Peer-Reviewed)**

9. **Chen, W.**, Lee, D., Balogun, O., & Chen, W. (2022, August). Hierarchical Deep Generative Models for Design Under Free-Form Geometric Uncertainty. In *ASME 2022 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC-CIE)*. St. Louis, MO. Vol. 86236, p. V03BT03A042.
8. Lee, D., Chan, Y. C., **Chen, W.**, Wang, L., van Beek, A., & Chen, W. (2022, August). T-METASET: Task-Aware Generation of Metamaterial Datasets by Diversity-Based Active Learning. In *ASME 2022 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC-CIE)*. St. Louis, MO. Vol. 86229, p. V03AT03A011.
7. Nobari, A., **Chen, W.**, & Ahmed, F. (2021, August). PcDGAN: A Continuous Conditional Diverse Generative Adversarial Network For Inverse Design. In *Proceedings of the 27th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD '21)*. Virtual. pp. 606-616. doi:10.1145/3447548.3467414.
6. Nobari, A., **Chen, W.**, & Ahmed, F. (2021, August). Range-GAN: Range-Constrained Generative Adversarial Network for Conditioned Design Synthesis. In *ASME 2021*

- International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC-CIE)*. Virtual. Vol. 85390, p. V03BT03A039. doi:10.1115/DETC2021-69963.
5. **Chen, W.** & Ramamurthy, A. (2021, January). Deep Generative Model for Efficient 3D Airfoil Parameterization and Generation. In *AIAA Scitech 2021 Forum*. Virtual. p. 1690. doi:10.2514/6.2021-1690.
  4. **Chen, W.** & Ahmed, F. (2020, August). PaDGAN: A Generative Adversarial Network for Performance Augmented Diverse Designs. In *ASME 2020 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC-CIE)*. Virtual. Vol. 84003, p. V11AT11A010. doi:10.1115/DETC2020-22729.
  3. **Chen, W.**, Chiu, K., & Fuge, M. (2019, January). Aerodynamic design optimization and shape exploration using generative adversarial networks. In *AIAA Scitech 2019 Forum*. San Diego, CA. p. 2351. doi:10.2514/6.2019-2351. **(Invited talk)**
  2. **Chen, W.**, Jeyaseelan, A., & Fuge, M. (2018, August). Synthesizing designs with inter-part dependencies using hierarchical generative adversarial networks. In *ASME 2018 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC-CIE)*. Quebec City, Canada. Vol. 51753, p. V02AT03A007. doi:10.1115/DETC2018-85339.
  1. **Chen, W.**, Chazan, J., & Fuge, M. (2016, August). How designs differ: Non-linear embeddings illuminate intrinsic design complexity. In *ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC-CIE)*. Charlotte, NC. Vol. 50107, p. V02AT03A014. doi:10.1115/DETC2016-60112.

#### **Workshop (Peer-Reviewed)**

4. Zhang, H., **Chen, W.**, Rondinelli, J., & Chen, W. (2023, October). Mitigating Bias in Scientific Data: A Materials Science Case Study. In *NeurIPS 2023 AI for Science Workshop*.
3. Wang, J., **Chen, W.**, Da, D., Fuge, M., & Rai, R. (2022, July). IH-GAN: A Conditional Generative Model for Inverse Design of Heterogeneous Cellular Structures. In: Workshop on Machine Learning in Computational Design, *Thirty-ninth International Conference on Machine Learning (ICML)*.
2. **Chen, W.**, Lee, D., & Chen, W. (2022, February). Deep Generative Models for Design Under Uncertainty. In: Workshop on AI for Design and Manufacturing (ADAM), *Thirty-Sixth AAAI Conference on Artificial Intelligence (AAAI)*.
1. **Chen, W.** & Ahmed, F. (2020, July). MO-PaDGAN: Generating Diverse Designs with Multivariate Performance Enhancement. In: Workshop on Negative Dependence and Submodularity: Theory and Applications in Machine Learning, *37th International Conference on Machine Learning (ICML)*.

#### **Preprint**

3. **Chen, W.**, Sun, R., Lee, D., & Portela, C. M. (2023). Generative Inverse Design of Metamaterials with Functional Responses by Interpretable Learning. arXiv preprint arXiv:2401.00003. *(submitted to PNAS)*
2. **Chen, W.** & Fuge, M. (2020). Adaptive Expansion Bayesian Optimization for Unbounded Global Optimization. arXiv preprint arXiv:2001.04815.
1. **Chen, W.** & Fuge, M. (2018). BézierGAN: Automatic Generation of Smooth Curves from Interpretable Low-Dimensional Parameters. arXiv preprint arXiv:1808.08871.

#### **CITATIONS**

The total number of citations (both self and independent) from international journals and conferences is **764** with H-index **15** (as of December 15, 2023). Please see my Google Scholar page <https://scholar.google.com/citations?user=ULTyOWMAAAJ&hl> for more details.

## RESEARCH GRANTS

Proposal “AI-Enabled Discovery and Design of Programmable Material Systems” (led by Prof. Wei Chen at Northwestern) won NSF **BRITE Fellow** award, 2022 (Role: **lead of “Task 2 – Learn and Generate: An Interpretable Machine Learning-Based Approach”**; Award amount: \$999,809)

Proposal “NSF Engineering Research Center for Hybrid Autonomous Manufacturing Moving from Evolution to Revolution (ERC-HAMMER)” (led by Ohio State University) funded by NSF, 2022 (Role: contributor; Award amount: \$25,938,414)

Proposal “AI-Driven Robust Geometric Optimization under Real-World Uncertainty” (led by Prof. Wei Chen at Northwestern) won Northwestern University’s Catalyst Award Fund, 2021 (Role: **primary contributor**; Award amount: \$100,000)

Proposal “Generation of Structurally-Functional Parametric Mechanical Shapes” won Siemens’s Innovation Core Technology (ICT) funding, 2020 (Role: **Principal Investigator**; Award amount: €300,000)

## ACADEMIC SERVICE

### Session Chair

ASME IDETC, AI-Driven Design Innovation

ASME IDETC, Novel AI or ML Frameworks for Design or Systems Science

### Journal Reviewer

Structural and Multidisciplinary Optimization

Journal of Mechanical Design

Computer-Aided Design

Design Science

AIAA Journal

Applied Soft Computing

Journal of Manufacturing Processes

Journal of Computational Design and Engineering

Engineering Optimization

Journal of Industrial Information Integration

IEEE Transactions on Industrial Electronics

IEEE Transactions on Engineering Management

Artificial Intelligence for Engineering Design, Analysis and Manufacturing

International Journal of Production Research

Frontiers of Information Technology & Electronic Engineering

### Conference Reviewer

ASME International Design Engineering Technical Conference (IDETC)

ACM Symposium on Computational Fabrication (SCF)

SME North American Manufacturing Research Conference (NAMRC)

## INVITED TALKS

“GAN-DUF: Hierarchical Deep Generative Models for Design Under Free-Form Geometric Uncertainty”

*SIAM UQ24 mini-symposium “Generative Models for Physics-based Forward and Inverse Problems”*, Feb 27, 2024

“Generative Design of Multiscale Heterostructures with Blended Multiclass Metamaterials”  
*SES 2023 Eringen Medal Symposium*, Oct 10, 2023

“PaDGAN: Learning to Generate High-Quality Novel Designs”  
*ASME IDETC 2022 Spotlight Session*, Aug 16, 2022

“Aerodynamic design optimization and shape exploration using generative adversarial networks”  
*AIAA Scitech 2019 Forum*, Jan 11, 2019

**TEACHING  
EXPERIENCE**

**MEEN 401 Introduction to Mechanical Engineering Design**

The design innovation process; need definition, functional analysis, performance requirements and evaluation criteria, conceptual design evaluation, down-selected to an embodiment; introduction to systems and concurrent engineering; parametric and risk analysis, failure mode analysis, material selection, and manufacturability; cost and life cycle issues, project management.

**STUDENTS  
ADVISING**

**Ph.D.**

Haoxuan Mu

2023 – Present

Jiahui (Cal) Zheng

2023 – Present

**OUTREACH  
ACTIVITIES**

Advised a capstone design team at Weiss High School to create an electronic device that tracks food items in a fridge/pantry, Pflugerville, TX  
Nov 1, 2023 – Dec 18, 2023

Hosted a Society of Women Engineers (SWE) activity table at the annual *Kits, Cats, and Kids Block Party*, Evanston Township High School, Evanston, IL  
Sep 15, 2022