Mark D. Fuge

ETH Zürich, CLA J 23.1
Tannenstrasse 3, 8092 Zurich,
Switzerland

mafuge@ethz.ch
+41 44 632 72 79
ETHZ Webpage

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Google Scholar Profile: Mark D. Fuge
ORCID: [0000-0003-3819-8895](0000-0003-3819-8895)

Academic Appointments at ETH Zürich

- **Full Professor and Chair of Artificial Intelligence in Engineering Design**
  Department of Mechanical and Process Engineering 07/2024–Present

Academic Appointments at UMD

- **Associate Professor**, Department of Mechanical Engineering 07/2021–06/2024
  Affiliate Associate Professor, Institute for Systems Research 07/2021–06/2024

- **Assistant Professor**, Department of Mechanical Engineering 08/2014–06/2021
  Tenure-track start date: 8/01/2014
  Affiliate Assistant Professor, Institute for Systems Research 05/2018–07/2021
  University of Maryland, College Park, MD

Education

- Ph.D., Mechanical Engineering, University of California at Berkeley, Aug. 2010–Aug. 2014
  Dissertation: *Collaborative Design Informatics: Leveraging Big Data to Create Better Designs*.
  Advisor: Professor Alice Agogino.
- M.S., Mechanical Engineering, Carnegie Mellon University, Aug. 2009–Dec. 2010
  Advisor: Professor Levent Burak Kara.
- B.S., Mechanical Engineering, Carnegie Mellon University, Aug. 2005–May 2009

Awards and Honors

- E. Robert Kent Teaching Award for Junior Faculty 2023
- *Journal of Mechanical Design* "Associate Editor Award" 2022
- National Science Foundation (NSF) CAREER Award 2020
- UMD Provost Teaching Innovation Grant 2020
- *Journal of Mechanical Design* "2019 Guest Editor Award" 2019
- *Journal of Mechanical Design* "Reviewers with Distinction" Award 2018
- Defense Advanced Research Projects Agency (DARPA) Young Faculty Award 2017
- UMD Academy for Innovation and Entrepreneurship Faculty Fellowship 2017
- Mentor of the Year Award—UMD Honors College Gemstone Program 2017
- National Defense Science and Engineering Graduate (NDSEG) Fellowship 2012

Selected Research Publications

- Qiuyi Chen and **Mark Fuge**. "Compressing Latent Space via Least Volume" **International Conference on Learning Representations (ICLR)**, Vienna, Austria (May 2024).
- Qiuyi Chen and **Mark Fuge**. "Characterizing Designs via Isometric Embeddings: Applications to Airfoil Inverse Design." **Journal of Mechanical Design** 146(5) (2024)

- Sangeeth Balakrishnan, Francis G. VanGessel, Brian C. Barnes, Ruth Doherty, William Wilson, Zois Boukouvalas, **Mark Fuge**, and Peter Chung. "Machine Learning for Shock Compression of Solids using Scarce Data" **Journal of Applied Physics** 133(15) (2023)

- Jun Wang, Wei (Wayne) Chen, Daicong Da, **Mark Fuge**, and Rahul Rai. "IH-GAN: A conditional generative model for implicit surface-based inverse design of cellular structures." **Computer Methods in Applied Mechanics and Engineering** 396 (2022)

- Seyede Fatemeh Ghoreishi, Ryan D. Sochol, Dheeraj Gandhi, Axel Krieger, and **Mark Fuge**. "Bayesian Optimization for Design of Multi-Actuator Soft Catheter Robots." **IEEE Transactions on Medical Robotics and Bionics (TMRB)** (July 2021). 3(2)

- Wei Chen, Kevin Chiu, and **Mark Fuge**, "Airfoil Design Parameterization and Optimization Using Bézier Generative Adversarial Networks" **AIAA Journal** 58(11) (Nov. 2020)

- Daniel Elton, Zois Boukouvalas, **Mark Fuge**, and Peter Chung. "Deep learning for Molecular Generation and Optimization - A Review of the State of the Art" **Molecular Systems Design & Engineering**. 4(4) (May 2019)

- Kevin Chiu and **Mark Fuge**. "Automatically Discovering Mechanical Functions from Physical Behaviors Via Clustering" **Journal of Computing and Information Science in Engineering (JCISE)** 24(8) (2024).

- Hidenori Hayashi, Jacqueline Contento, Hiroshi Matsushita, Paige Mass, Vincent Cleveland, Seda Aslan, Amartya Dave, Raquel dos Santos, Angie Zhu, Emmett Reid, Tatsuya Watanabe, Nora Lee, Tyler Dunn, Umar Siddiqi, Katherine Nurminsky, Vivian Nguyen, Keigo Kawaji, Joey Huddle, Luka Pocivavsek, Jed Johnson, **Mark Fuge**, Yue-Hin Loke, Axel Krieger, Laura Olivieri, Narutoshi Hibino, "Patient Specific Tissue Engineered Vascular Graft For Aortic Arch Reconstruction" **Journal of Thoracic and Cardiovascular Surgery (JTCVS) Open** In Press (2024)

- Eesh Kamrah, Seyede Fatemeh Ghoreishi, Zijian (Jason) Ding, Joel Chan, and **Mark Fuge**. "How Diverse Initial Samples Help and Hurt Bayesian Optimizers" **Journal of Mechanical Design** 145(11) (2023)

- Xiaolong Liu, Narutoshi Hibino, Yue-Hin Loke, Byeol Kim, Paige Mass, **Mark Fuge**, Laura Olivieri, and Axel Krieger. "Surgical Planning and Optimization of Patient-Specific Fontan Grafts With Uncertain Post-Operative Boundary Conditions and Anastomosis Displacement." **IEEE Transactions on Biomedical Engineering** (2022).

- Qiuyi Chen, Jun Wang, Phillip Pope, Wei (Wayne) Chen, **Mark Fuge**. "Inverse Design of 2D Airfoils using Conditional Generative Models and Surrogate Log-Likelihoods" **Journal of Mechanical Design**. 144(2) (February 2022)

- Xiaolong Liu, Byeol Kim, Yue-Hin Loke, Paige Mass, Laura Olivieri, Narutoshi Hibino, **Mark Fuge**, and Axel Krieger. "Semi-Automatic Planning and Three-dimensional Electrospinning of Patient-Specific Grafts for Fontan Surgery." **IEEE Transactions on Biomedical Engineering** (June 2021)

- Faez Ahmed, Sharath Ramachandran, **Mark Fuge**, Sam Hunter, and Scarlett Miller. "Design Variety Measurement using Sharma-Mittal Entropy" **Journal of Mechanical Design**. (June 2021) 143(6)

- Scarlett Miller, Sam Hunter, Elizabeth Starkey, Sharath Ramachandran, Faez Ahmed, and **Mark Fuge**. "How Should We Measure Creativity in Engineering Design? A Comparison of Social Science and Engineering Approaches" **Journal of Mechanical Design** 143(3) (Mar. 2021).

- Wei Chen and **Mark Fuge**. "Synthesizing Designs with Inter-Part Dependencies Using Hierarchical Generative Adversarial Networks," **Journal of Mechanical Design**. 141(11) (June 2019).

- Daniel Elton, Zois Boukouvalas, **Mark Fuge**, and Peter Chung. "Deep learning for Molecular Generation and Optimization - A Review of the State of the Art" **Molecular Systems Design & Engineering**. 4(4) (May 2019): 828-849.
- Faez Ahmed, Sharath Ramachandran, **Mark Fuge**, Sam Hunter, and Scarlett Miller. "Interpreting Idea Maps: Pairwise Comparisons Reveal What Makes Ideas Novel," **Journal of Mechanical Design**. 141(2) (Dec. 2018).

Selected Invited Talks

- **Keynote speaker** International Conference on Machine Learning (ICML) Workshop on Computational Design, July 27th, 2022, "Learning to Design Engineered Systems"
- **Panel speaker** ASME International Design Engineering Technical Conference – Workshop on *From Data to Design: Challenges and Opportunities across Industry and Academia*, August 25th, 2024
- ETH Zurich: Lost in Space: Design Manifolds Can Accelerate Design and Optimization Iterations Several Fold, March 21st, 2023
- Northwestern University: Optimal Transport in Design Manifolds and How Diversity Affects Gaussian Processes, September 9th, 2022
- UC Berkeley: Lost in Space: Design Manifolds Can Accelerate Design and Optimization Iterations Several Fold, March 11th, 2022
- Nuclear Regulatory Commission Data Science and AI Workshop: Introduction to Machine Learning and Deep Learning, June 19, 2021
- ASME TEC Webinar: Transforming Design and Manufacturing with Artificial Intelligence and Machine Learning, May 27, 2021
- ARPA-E DIFFERENTIATE Workshop on Generative Models: Caution: Optima in the mirror are closer than they appear; How Generative Models Accelerate Optimization Several-fold, April 15, 2021
- The Ohio State University: Lost in Space: Design Manifolds Can Accelerate Design and Optimization Iterations Several Fold, November 13, 2020
- Georgia Institute of Technology Frontiers of Mechanical Science Seminar Series: Lost in Space: Design Manifolds Can Accelerate Design and Optimization Iterations Several Fold, October 9, 2020
- Pennsylvania State University: Lost in Space: Design Manifolds Can Accelerate Design and Optimization Iterations Several Fold, August 31st, 2020
- Texas A&M University: Lost in Space: Design Manifolds Can Accelerate Design and Optimization Iterations Several Fold, July 17th, 2020
- Massachusetts Institute of Technology: Collaborative Design Informatics: Helping Communities Create Better Designs through Data, April, 2014

Selected Professional Service Activities

- Editorial Boards: *Journal of Mechanical Design*, *Computer Aided Design*.
- ASME IDETC DTM Technical Committee: Secretary (2018), Vice-Chair (2019), TC Chair (2020), Paper Chair (2026), Conference Chair (2027)
- Program Committee Member: International Conference on Design Creativity, Atlanta, GA 2016; International Conference on Engineering Design 2017, Vancouver, British Columbia, Canada; International Conference on Engineering Design 2019, Delft, The Netherlands; International Conference on Engineering Design 2023, Bordeaux, France.
- Advisory Board Member: Design Computing and Cognition 2020, Georgia Institute of Technology, Atlanta, GA