Amir M. Mirzendehdel, *Ph.D.*

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Aerospace Engineering Department
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Education

University of Wisconsin, Madison *Madison, WI*

Ph.D. in Mechanical Engineering *2014-2017*

Thesis: *Towards Integrating Topology Optimization and Additive Manufacturing*
Summary: Mathematical formulation, sensitivity analysis, and implementation of topology optimization considering *multi-material* designs, material *anisotropy*, and *support structures* in 3d printing.

University of Wisconsin, Madison *Madison, WI*

M.Sc. in Mechanical Engineering *2012-2014*

Thesis: *Assembly-Free Structural Dynamics on CPU and GPU*
Summary: A memory-efficient *implicit structural dynamics* solver using the Newmark-beta algorithm, where *matrix-free* deflated conjugate gradient was implemented to solve FEA on CPU and GPU.

Amirkabir University of Technology *Tehran, Iran*

B.Sc. in Aerospace Engineering *2008-2012*

Experience

The University of Kansas, Aerospace Engineering Department Lawrence, KS

- *Assistant Professor* *July 2025 - present*
  - Director of the Digital Engineering Laboratory (DEL) at KU
  - Graduate Committee Member

SRI International, Artificial Intelligence Center Palo Alto, CA

- *Senior Computer Scientist* *June 2023 - July 2025*
  - Developed multiple concept papers and full-proposals DARPA NaPSAC, DIU Digital Composites (accepted by the Program Manager for $2M), and DARPA METALS (awarded $6M).
  - Technical Lead for DAPRA METALS in developing a novel material-integrated design optimization where graded material properties are the explicit design variables.

Palo Alto Research Center (PARC) Palo Alto, CA

- *Senior Research Scientist* *July 2021 - May 2023*
  - Institutional PI on **$800k** government project from Advanced Research Project Agency - Energy (**ARPA-E**) at PARC as sub-contractor to GE. This resulted in a published article and successful development of a software tool for optimization of **turbomachinery component**s produced by **metal additive manufacturing** using numerical optimization, structural mechanics, and machine learning.

- *Research Scientist* *June 2018 - June 2021*
  - Technical lead for design optimization on DARPA TRADES.

- *Postdoctoral Researcher* *Sept. 2017 - May 2018*
  - Technical Lead in the Defense Advanced Research Project Agency (**DARPA**) TRAnsformative DESign (TRADES) program. Developed an **end-to-end software tool** as a **full-stack engineer** in C++ for digital design and manufacturing comprising visualization, analysis, design optimization, and manufacturing process planning to **solve challenge problem** that was validated and verified by NASA.

University of Wisconsin - Madison Madison, WI

- *Research Assistant* *Sep. 2012 - Aug. 2017*
  - Developed efficient design space exploration software tools in C++ for Multi-objective topology optimization for 3d printing considering multi-material designs, material anisotropy, and support structures to find the best **trade-off** between **performance**, **manufacturability**, and **cost**.
  - Developed scalable software tool for **large-scale implicit structural dynamics** on CPU and GPU and validated the results using ANSYS and SolidWorks.
  - FEA on distorted quadrilateral meshes (Student Poster Award at ASME/CIE 2013)

Research Grants

LAUNCH: Advancing STEM Ed. Thru NASA-Inspired Additive Manufacturing Aligned w/ NGSS *Feb. 2026 - May 2026*

- Sponsor: **NASA**
- Program: Kansas NASA EPSCoR Program
- Capacity: **Co-Investigator** leading all three workshops
- Award Amount: **$25K**
- Partner Institutions: Center for Teaching Excellence
- Description: Three workshops for 12 Kansas grades 6–12 teachers on CAD, 3D printing hardware/software, and experimental testing; provided printers, materials, and classroom-ready NGSS-aligned teaching modules.

MIDAS-X: Material-Integrated Design with Agile Sampling for Experimental Testing *Jan. 2024 - July 2025*

- Sponsor: **DARPA** Defense Sciences Office
- Program Manager: Dr. Andrew Detor
- Program: Multiobjective Engineering and Testing of Alloy Structures (METALS)
- Capacity: **Technical Lead** and the **Proposal Development Lead**, together with Prof. Adrian Lew, in PI's absence due to parental leave.
- Award Amount: **$6M** for 4 years
- Partner Institutions: UIUC, UCSD
- Description: MIDAS-X will develop rapid design, synthesis, testing, and qualification of high-performance, durable, and sustainable parts with continuously distributed novel alloys for DoD-relevant applications.

Design Optimization using ML for Complex Physics and Hybrid Manufacturing *Jan. 2023 - Dec. 2023*

- Sponsor: Xerox Corporation/SRI International
- Capacity: **sole Principal Investigator**
- Award Amount: **$1.34M** for 1 year
- Description: Develop physics-based ML design optimization tools for 1) complex coupled physics such as electromechanical or electromagnetic structures and 2) hybrid manufacturing processes such as additive friction-stir deposition or direct energy deposition followed by multi-axis machining.

IMPACT: design of Integrated Multi-physics, Producible Additive Components for Turbomachinery *Aug. 2020 - Jan. 2022*

- Sponsor: **ARPA-E**
- Program Manager: Dr. David Tew
- Program: Design Intelligence Fostering Formidable Energy Reduction and Enabling Novel Totally Impactful Advanced Technology Enhancements (DIFFERENTIATE)
- Capacity: **Principal Investigator** on subcontract to GE Global Research
- Award Amount: **$800K** (for PARC)
- Partner Institutions: GE Global Research (lead organization), Oak Ridge National Laboratory
- Description: Develop design optimization tools for the laser powder bed fusion-based additive manufacturing of turbomachinery components. Integrate multi-physics topology optimization (PARC) with a fast machine learning-based producibility evaluations extracted from large training datasets comprising high-fidelity physics-based simulations and experimental validation studies.

FIELDS: Fabricating with Interoperable Engineering, Planning, Design, and Analysis *Jan. 2017- Dec. 2020*

- Sponsor: **DARPA** Defense Sciences Office
- Program Manager: Dr. Jan Vandenbrande
- Program: TRAnsformative DESign (TRADES)
- Capacity: **Technical Lead** in design and analysis, the main point of contact with sub-contractors

- Award Amount: **$3.95M**
- Partner Institutions: Intact Solutions (subcontractor to PARC), Oregon State University (subcontractor to PARC)
- Description: FIELDS provides the foundational research that enables the automatic compilation of design requirements into fabrication instructions for manufacturable designs, using field representations as the a common language to combine implicit shape description, physical analysis, and manufacturability.

Professional Activities

International Committee Member - SPM 2022, 2023 *June 2022, 2023*

- SPM is an international conference with peer-reviewed papers and low acceptance rates (23%), and is the premier conference for Solid Modeling and Computer-Aided Design.
- Serving as a committee member to ensure the highest research standards.

Minisymposium Organizer - SPM 2021 *Sep. 2021*

- Sole organizer of **AI-Assisted Exploration of Design Spaces for Modern Manufacturing** mini-symposium that covers topics in efficient design space exploration while ensuring manufacturability using AI.
- Responsibilities including planning and organizing the mini-symposium, identifying and inviting experts and presenters, and conducting the session

Session Chair - ASME/CIE 2021 *Aug. 2021*

- Co-organized the ASME CIE special session on *Design, Simulation and Optimization for Additive Manufacturing*, with responsibilities including organizing technical paper review assignments, paper selection, and conducting the session.

Technical Paper Review *2014 - present*

- Providing reviews for technical papers submitted to conferences and journals including SPM, JCAD, JCISE, ASME IDETC, IJDM, Additive Manufacturing Letters, Composite Structures, Structural and Multidisciplinary Optimization, Journal of Mechanical Design, Optimization and Engineering.

Courses

AE507: Aerospace Structures I *Fall 2026*

- Provides analysis and preliminary design of aerospace structures, including stress, deflection, material failure, connections, and buckling of thin-walled and semimonocoque structures.

AE700: Probabilistic Engineering Design *Spring 2026*

- Provides an overview of probability (random variables and distributions), reliability estimation methods, and reliability-based design optimization to quantify uncertainty and improve engineering decisions in aerospace and structural systems.

AE700: Shape and Topology Optimization *Fall 2025*

- Provides a hands-on introduction to shape and topology optimization for advanced structural design. It includes a brief overview of solid modeling, meshing, and finite element analysis for elasticity, thermal, thermo-elasticity, and fluid flow. Parametric shape optimization is explored through random search, direct and indirect finite difference sensitivity analysis, and global search. The course also covers topology optimization methods, including the density-based method, level-set method, evolutionary method, and Pareto-tracing

Open-Source Codes

2. **STORX**: Shape and Topology Optimization for Research and Experimentation
   Language: MATLAB
   Release date: Aug. 2026
   Code: https://github.com/DEL-KU/storx
   Toolbox: MATLAB File Exchange

1. **PILL-CoDe**: Inverse Design of Polypills via Automatic Differentiation for Prescribed Drug-Release Kinetics
   Language: Python
   Release date: Dec. 2025
   Link: https://github.com/DEL-KU/PILL-CoDe

Other Educational Contributions

Textbook on *Introduction to Shape and Topology Optimization using MATLAB* *In Preparation*

- Co-authoring a self-contained textbook for senior undergraduate and graduate students interested in computational design and topology optimization.
- The textbook covers fundamental topics including geometric representations, finite element analysis, numerical optimization, and sensitivity analysis, as well as established approaches to topology optimization like density-based, level-set, and evolutionary methods.
- An accompanying open-source MATLAB code will be provided to the public.

Guest Lecturer for ME 748: Topology Optimization *Nov. 2022*

- Gave a lecture on **Topology Optimization for Manufacturing** to graduate students and provided an overview of mathematical principles of incorporating various manufacturing constraints within topology optimization, including complex additive and subtractive constraints.
- The Course was taught by Prof. Krishnan Suresh.

Tutorial on *A Hands-On Introduction to Topology Optimization* *Sep. 2017*

- Co-authored a tutorial for the software PareTO (Pareto tracing topology optimization) for users and engineers
- The tutorial was used in multiple hands-on workshops to provide an introduction to the field.

Workshop: Topology Optimization *2017, 2019*

- Co-taught the workshop on *Topology Optimization* in ASME/CIE 2019, Aneheim, CA.
- Co-taught the workshop on *Topology Optimization* in ASME/CIE 2017, Cleveland, OH.
- Co-taught the workshop *A Hands-On Introduction to Topology Optimization*, Madison, WI, 2017.

Guest Lecturer for ME 514: Additive Manufacturing *Feb. 2016*

- Gave a hands-on lecture on **Topology Optimization for AM** to graduate students. Introduced the students to concepts of DfAM and topology optimization and gave tutorials on how to use software that was developed in-house.
- The Course was taught by Prof. Natalie Rudolph.

Teaching Assistant for ME 331: Geometric Modeling for Engineering Applications *Jan. 2013 - Jun. 2014*

- Taught principles of **geometric modeling**, theories of constraint-based design, GD&T, drafting and drawing. In addition, taught feature-based and assembly-based CAD modeling using the commercial **software NX**.

Awarded Patents

9. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi *Avoiding trapping unused additive manufacturing materials during production*, US Patent US12384116B2.
8. Q. Ye, M. Patterson, **A.M. Mirzendehdel**, M. Behandish, *Modifying shape based on level set representation to reduce support in additive manufacturing*, US Patent US12125161B2.
7. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi *Automated design generation for additive manufacturing with an accessible support volume*, US Patent US12240182B2.
6. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Physics-Aware Automatic Spatial Planning for Subtractive and Hybrid Manufacturing*, US Patent US20230071648A1.
5. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Hybrid manufacturing system and method that reduces inaccessible support structures*, US Patent US20220193774A1.
4. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Automated design and optimization for accessibility in subtractive manufacturing*, US Patent US11669661B2.
3. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Method and System for Part Design Using Heterogeneous Constraints*, US Patent US11775703B2.
2. M. Behandish, **A.M. Mirzendehdel**, S. Nelaturi, *Method and System for Hierarchical Multi-Scale Part Design by the Aid of a Digital Computer*, US Patent US11507054B2.
1. K. Suresh, **A.M. Mirzendehdel**, *Support structure constrained topology optimization for additive manufacturing*, US Patent US10613496B2.

Patent Applications Pending

17. **A.M. Mirzendehdel**, Adrian Lew, Morad Behandish *Material-Integrated Design Optimization*, (provisional patent filed), 2025.
16. **A.M. Mirzendehdel**, Matt Patterson, Morad Behandish, Eric Garner, *An Automatic Ply Splicing Strategy for Laminar Composite Manufacturing*, (provisional patent filed), 2025.
15. A. Chandrasekhar, **A.M. Mirzendehdel**, M. Behandish, *Optimization of a design using a physics solver integrated with a neural network*, US Application #17/714, 849.
14. R. Wang, A. Bhattacharyya, Q. Ye, C. Morris, **A.M. Mirzendehdel**, M. Behandish, *Structural Design by Topology Optimization for lumped parameter systems*, US Application #17/831125.
13. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Method and System for Automated Design Generation for Additive Manufacturing with Producibility Surrogate Models*, US Application US20230306160A1.
12. A. Chandrasekhar, **A.M. Mirzendehdel**, M. Behandish, *Automated Optimization of Fiber Reinforced Composites using Neural Networks and Black-Box Solvers*, US Application #17/714849.
11. C. Morris, **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *A Method for Automated Design Generation with Connectivity Constraints*, US Application #63/398636.
10. C. Morris, **A.M. Mirzendehdel**, M. Behandish, *Co-generation of collision-free shapes in arbitrary relative motion*, US Patent US20230394181A1.
9. C. Morris, **A.M. Mirzendehdel**, M. Behandish, *Method and system for automated design generation with inertial constraints*, US Patent US20240202402A1.
8. A. Bhattacharyya, Raman Goyal, **A.M. Mirzendehdel**, Morad Behandish,*Design of intelligent resilient structures via automatic placement of sensor and smart actuators* , US Application US20240273245A1.
7. Raman Goyal, A. Bhattacharyya, **A.M. Mirzendehdel**, Morad Behandish,*Design of active resilient structures* , US Application US20240265157A1.
6. **A.M. Mirzendehdel**, M. Behandish, *Generating consolidated designs of a production model to replace multiple parts of an assembly*, US Application US20230267243A1.
5. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Method and system for automated design generation for additive manufacturing utilizing machine learning based surrogate model for cracking*, US Application $US20230306160A1$.
4. A. Chandrasekhar, **A.M. Mirzendehdel**, M. Behandish, *Optimization of a design using a physics solver integrated with a neural network*, US Application US20230325561A1.
3. C. Morris,**A.M. Mirzendehdel**, M. Behandish, *Topology optimization with locally differentiable complement space connectivity*, US Patent US20240061965A1.
2. R. Wang, A. Bhattacharyya, Q. Ye, C. Morris, **A.M. Mirzendehdel**, Morad Behandish, *Methods and systems of geometric representation generation based on a system-level model*, US Patent $US20230394191A1$.
1. C. Morris, **A.M. Mirzendehdel**, M. Behandish, *Method and System for Automated Codesign of Collision Free Components with Controllable Interfaces*, US Patent $US20230394181A1$.

Book

- **A.M. Mirzendehdel**, K. Suresh, *Introduction to Shape and Topology Optimization using MATLAB*, *In Preparation.*

Book Chapter

- **A.M. Mirzendehdel**, K. Suresh, *Efficient Multi-Material Topology Optimization*, ASME ACIER publications, 2018.

Tutorial

- **A.M. Mirzendehdel**, K. Suresh, *A Hands-On Introduction to Topology Optimization*, First Edition, CreateSpace Independent Publishing Platform; ISBN: 1976480604, September 2017.

Journal Papers

17. **A.M. Mirzendehdel**, K. Suresh, *STORX: An Open-Source Object-Oriented Framework for Shape and Topology Optimization in MATLAB*, arXiv preprint, arXiv:2606.17291, 2026.
16. R. Padhy, A. Chandrasekhar, **A.M. Mirzendehdel***, *PILL-CoDe: Inverse Design of Polypills via Automatic Differentiation for Prescribed Drug-Release Kinetics*, Computer-Aided Design (special issue on AI+Design), 2026.

15. **A.M. Mirzendehdel**, Adrian Lew, Morad Behandish *Material-Integrated Design Optimization*, (under preparation), 2026.
14. **A.M. Mirzendehdel**, N. Iyer, S. Raghavan, et al., *PATO: Producibility-Aware Topology Optimization using Deep Learning for Metal Additive Manufacturing*, International Journal on Interactive Design and Manufacturing (IJIDeM), 2024.
13. **A.M. Mirzendehdel**, M. Behandish, *Co-design Optimization of Moving Parts for Compliance and Collision Avoidance*, SPM special issue, Genoa, Italy, 2023.
12. G. Harabin, **A.M. Mirzendehdel**, M. Behandish, *Deep Neural Implicit Representation of Accessibility for Multi-Axis Manufacturing*, SPM special issue, Genoa, Italy, 2023.
11. A. Chandrasekhar, **A.M. Mirzendehdel**, M. Behandish, and K. Suresh, *FRC-TOuNN: Topology Optimization of Continuous Fiber Reinforced Composites using Neural Network*, Computer-Aided Design, 2023.
10. **A.M. Mirzendehdel**, M. Behandish, and S. Nelaturi, *Topology Optimization for Manufacturing with Accessible Support Structures*, Computer-Aided Design, 2022.
9. **A.M. Mirzendehdel**, M. Behandish, and S. Nelaturi, *Optimizing Build Orientation for Support Removal using Multi-Axis Machining*, Computers & Graphics (special issue on Computational Fabrication), 2021.
8. **A.M. Mirzendehdel**, M. Behandish, and S. Nelaturi, *Topology Optimization with Accessibility Constraint for Multi-Axis Machining*, Computer-Aided Design, (special issue on Process Planning for Additive/Hybrid Manufacturing), 2020.
7. **A.M. Mirzendehdel**, M. Behandish, and S. Nelaturi, *Exploring Feasible Design Spaces for Heterogeneous Constraints*, Computer-Aided Design (special issue on Advances in Generative Design), 2019.
6. M. Behandish, **A.M. Mirzendehdel**, and S.Nelaturi, *A Classification of Topological Discrepancies in Additive Manufacturing*, Computer-Aided Design, SPM special issue, 2019.
5. S. Nelaturi, M. Behandish, **A.M. Mirzendehdel**, J. de Kleer, *Automatic Support Removal for Additive Manufacturing Post Processing*, Computer-Aided Design, SPM special issue, 2019.
4. **A.M. Mirzendehdel**, B. Rankouhi, and K. Suresh, *Strength-based Topology Optimization for Ani-sotropic Parts*, Additive Manufacturing, 2018.
3. **A.M. Mirzendehdel** and K. Suresh, *Support Structure Constrained Topology Optimization for Additive Manufacturing*, Computer-Aided Design, vol. 81, pp. 1–13, Dec. 2016.
2. **A.M. Mirzendehdel** and K. Suresh, *A Pareto-Optimal Approach to Multimaterial Topology Optimization*, Mechanical Design 137, no. 10 (2015): 101701.
1. **A.M. Mirzendehdel** and K. Suresh, *A Deflated Assembly Free Approach to Large-Scale Implicit Structural Dynamics*, Computational and Nonlinear Dynamics, vol. 10, no. 6 (2015): 061015.

Peer-Reviewed Conference Papers

9. **A.M. Mirzendehdel***, M. Behandish, *Co-design Optimization of Moving Parts for Compliance and Collision Avoidance*, Solid and Physical Modeling Symposium, Genoa, Italy, 2023.
8. G. Harabin*, **A.M. Mirzendehdel**, M. Behandish, *Deep Neural Implicit Representation of Accessibility for Multi-Axis Manufacturing*, Solid and Physical Modeling Symposium, Genoa, Italy, 2023.
7. A. Chandrasekhar, **A.M. Mirzendehdel***, M. Behandish, and K. Suresh, *FRC-TOuNN: Topology Optimization of Continuous Fiber Reinforced Composites using Neural Network*,**Invited Talk**, Solid and Physical Modeling Symposium, Genoa, Italy, 2023.
6. A. Bhattacharyya, **A.M. Mirzendehdel***, *Topology Optimization for Design of Resilient Structures using Smart Materials*, AIAA AVIATION 2023 Forum, June 2023.
5. J. Chen*, M. Patterson, **A.M. Mirzendehdel**, M. Behandish, *Automatic Shape Modification for Self-Supporting Structures in Additive Manufactuirng*, ASME/CIE Conference, virtual, August 2022.
4. C. Morris*, **A.M. Mirzendehdel**, M.d Behandish, *Topology Optimization With Locally Evaluable Complement Space Connectivity*, ASME/CIE Conference, virtual, August 2021.
3. **A.M. Mirzendehdel***, K. Suresh, *Support-Structure Constrained Topology Optimization for Additive Manufacturing*,**Invited Talk**, Solid and Physical Modeling Symposium, Berkeley, CA, June 2017.
2. **A.M. Mirzendehdel***, K. Suresh, *Multi-material Topology optimization for additive manufacturing*, Proceedings, ASME/CIE Conference, Boston, MA, August 2015.
1. **A.M. Mirzendehdel***, K. Suresh, *A Fast Time-Stepping Strategy for the Newmark-Beta Method*, Proceedings, ASME/CIE Conference, Buffalo, NY, August 2014.

Non-Refereed and/or Invited Technical Presentations

7. **A.M. Mirzendehdel***, Adrian Lew, M. Behandish, *Material-Integrated Design Optimization with Realizability Constraint*, WCCM Session 1107, Vancouver, CA, July 2024.
6. *Topology Optimization with Heterogeneous Constraints*, **Invited Talk**, Applied Mathematics Seminar, **UC Santa Cruz**, April 2023.
5. *Producibility-Aware Topology Optimization*, Talk, AI-Assisted Exploration of Design Spaces for Modern Manufacturing, SIAM **SPM** (virtual), September 2021.
4. *Cost-Effective Functional Designs for Additive Manufacturing*, Talk, **Sandia National Labs** Topology Optimization Roundtable, Atlanta, GA, March 2017.
3. *Effect of Material Anisotropy on Topology Optimized Designs for Additive Manufacturing*, Talk, **Solid Freeform Fabrication** Symposium, Austin, TX, August 2016.
2. *Support-Structure Constrained Topology Optimization for Additive Manufacturing*, Poster, **Solid Freeform Fabrication** Symposium, Austin, TX, August 2016.
1. *Finite Element over Tangled Mesh*, Poster, **ASME/CIE Conference**, Portland, OR, August 2013.

Awards

Early Career Award, University of Wisconsin-Madison, College of Engineering *2025*
- Awarded by UW-Madison College of Engineering to outstanding early-career alumni, one from each department.

Golden Acorn Award, Palo Alto Research Center *2022*
- Awarded by PARC for patents with expected long-term impact and commercialization opportunities.

Technical Excellence Award, Palo Alto Research Center *2021, 2020, 2019, 2018*
- Awarded by PARC for research and technical excellence in design and manufacturing, and growing the research portfolio and teams for 3D technologies.

Leadership Retention Award, Palo Alto Research Center *2020*
- Awarded by Xerox to company-wide top performers.

Travel Award, Shape and Physics Modeling *2017*
- Awarded by SPM to present a distinguished paper recently published in JCAD.

Travel Award, Solid Freeform Fabrication, Austin, TX *2016*

Poster Award, ASME CIE, Portland, OR *2013*

2nd Place Award, International Micro-Aerial Vehicles competition (I-MAV2011), Delft, Netherlands *2011*