Amir M. Mirzendehdel, *Ph.D.*

Assistant Professor, Aerospace Engineering
University of Kansas

Email: amirzend@ku.edu
Office: 2119C Learned Hall
1530 W. 15th St., Lawrence, KS 66045

Assistant Professor with **10+** years of interdisciplinary R&D experience, with research interests in developing next-generation mathematical models, computational representations, and efficient algorithms for automated computer-aided design, analysis, and manufacturing (CAx).
Served as PI/Technical Lead for multiple projects **awarded** by government agencies such as DARPA and DOE.

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*

SRI International, Future Concepts Division (formerly PARC) — 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.
  - Project lead for a proof-of-concept demo on topology optimization for nuclear fusion applications in collaboration with an industry partner.
  - Developed a proof-of-concept demo on speech-operated generative design software.
  - Sole developer of an automated design for assembly tool to co-design parts in relative motion with respect to performance and collision avoidance.

Palo Alto Research Center (PARC) — Palo Alto, CA

- *Senior Research Scientist* — *July 2021 - May 2023*
  - Project lead for research and development of a novel software tool for high-fidelity implicit representation of the **collision** space for multi-axis manufacturing using **neural-network**.
  - Project lead for research and development of a cutting edge software tool for topology optimization of **continuous fiber-reinforced composites** using **neural networks**.
  - Lead inventor in developing design optimization techniques and computational framework for multi-disciplinary **part consolidation** for milling and 3D printing to increase supply-chain resiliency.

- Lead inventor and manager 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.
- Project lead for research and development of an advanced software tool for simultaneous structural design and placement of **sensors** and **actuators** to design for **resiliency**.

- *Research Scientist* *June 2018 - June 2021*
  - Lead contributor on design optimization and manufacturing planning for **multi-axis machining**.
  - Lead contributor to develop a tool to accurately **predict** and **classify** the **discrepancies** between as-designed and as-manufactured 3d printed parts using the compact and sparse OpenVDB data structure.
  - Sole contributor in developing a tool to **optimize build orientation** for 3d printing **accessibility** of support structures for **milling**.
  - Sole contributor in developing a tool to **optimize structural components** for **hybrid additive-then-subtractive** manufacturing process.

- *Postdoctoral Researcher* *Sept. 2017 - May 2018*
  - Lead contributor 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

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.

UHD-SoS: Ultra High Definition Structures of Structures *Jan. 2017- Dec. 2020*

- Sponsor: **DARPA** Defense Sciences Office
- Program: TRAnsformative DESign (TRADES)
- Program Manager: Dr. Jan Vandenbrande
- Capacity: **Technical Lead** in manufacturability analysis of high-resolution structures
- Award Amount: **$1M** (for PARC)
- Partner Institutions: Siemens Corporate Research (lead organization), Georgia Tech, Michigan State University
- Description: Represent designs as a sequence of program code providing a concise parametric description representation for complex geometries, explore resulting design spaces, and providing manufacturability analysis (PARC) for such designs.

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

AE700: Shape and Topology Optimization *Fall 2025*

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

6. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Physics-Aware Automatic Spatial Planning for Subtractive and Hybrid Manufacturing*, US Patent #11, 656, 602.
5. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Hybrid manufacturing system and method that reduces inaccessible support structures*, US Patent #11, 577, 321.
4. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Automated design and optimization for accessibility in subtractive manufacturing*, US Patent #20210390229.
3. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Method and System for Part Design Using Heterogeneous Constraints*, US Patent #20210073349.
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#20200209832.
1. K. Suresh, **A.M. Mirzendehdel**, *Support structure constrained topology optimization for additive manufacturing*, US Patent #20180079149.

Patent Applications Pending

14. **A.M. Mirzendehdel**, Adrian Lew, Morad Behandish *Material-Integrated Design Optimization*, (provisional patent filed), 2025.
13. **A.M. Mirzendehdel**, Matt Patterson, Morad Behandish, Eric Garner, *An Automatic Ply Splicing Strategy for Laminar Composite Manufacturing*, (provisional patent filed), 2025.
12. 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.
11. 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 Application #17/831, 125.
10. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi *Avoiding trapping unused additive manufacturing materials during production*, US Application #17/816, 483.
9. C. Morris,**A.M. Mirzendehdel**, M. Behandish, *Topology optimization with locally differentiable complement space connectivity*, US Application #18/086, 048.
8. **A.M. Mirzendehdel**, M. Behandish, *Method and System for Automated Part Consolidation for Manufacturing and Complexity* , US Application #63/312757.
7. C. Morris, **A.M. Mirzendehdel**, M. Behandish, *Method and System for Automated Codesign of Collision Free Components with Controllable Interfaces*, US Application #17/831790.
6. Q. Ye, M. Patterson, **A.M. Mirzendehdel**, M. Behandish, *Modifying shape based on level set representation to reduce support in additive manufacturing*, US Application #17/715, 631.
5. 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.
4. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Method and System for Automated Design Generation for Additive Manufacturing with Producibility Surrogate Models*, US Application #17/706068.
3. A. Chandrasekhar, **A.M. Mirzendehdel**, M. Behandish, *Automated Optimization of Fiber Reinforced Composites using Neural Networks and Black-Box Solvers*, US Application #17/714849.
2. **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, *Prediction of Removability of Excess Material from Internal Channels of Additively Manufactured Parts*, US Application #17/816483.
1. C. Morris, **A.M. Mirzendehdel**, M. Behandish, S. Nelaturi, A Method for Automated Design Generation with Connectivity Constraints, US Application #63/398636.

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

15. **A.M. Mirzendehdel**, Adrian Lew, Morad Behandish *Material-Integrated Design Optimization*, (under DARPA DISTAR review), 2024.
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. *Material-Integrated Design Optimization with Realizability Constraint*, **Invited Talk**, 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*