

# Mohammad Reza Farahani

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## Professional Summary

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Innovative Mechanical Engineer and Product Designer with expertise in multifunctional yarns and textiles (Wearables and heart stents). Adept at integrating CAD, simulation, and rapid prototyping to design patient-centered solutions. Skilled in material characterization and machine design with strong background in product development, human-centered design, and regulatory considerations for medical devices. Passionate about bridging engineering and design to create solutions for future.

## Education

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### University of Minnesota

PhD student in *Mechanical Engineering*, Minor in *Product Design*

### Sharif University of Technologies

M.Sc. in *Mechanical Engineering*

Thesis: *Optimal design of high-speed spindle bearings to reduce NRRO*

Jan 2023 - Present

Advisor: Dr. Julianna Abel

2015 - 2017

Advisor: Dr. Saeed Khodaygan

## Research Experience

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### University of Minnesota, USA

Graduate Research Assistant

Jul 2023 - Present

Advisor: Dr. Julianna Abel

#### Design of Active Materials and Structures Lab (DAMSL)

- Developed models using MATLAB to simulate microscale kinematics of Nitinol yarns, optimizing macroscale mechanical behavior for integration into wearable devices (Implemented Genetic Algorithm optimization method)
- Characterized smart materials using advanced tools like Differential Scanning Calorimeters (DSC) and Dynamic Mechanical Analysis (DMA).
- Designed and fabricated SMA twisted yarns using a custom-built spinning machine (tuned twist profiles for enhanced mechanical response and repeatability)
- Constructed a framework and defined a method to capture the yarn packing density (This included a series of skills such as molding, using resin, working with polishing machine, light microscopy, and image processing)
- Developed and custom coil machine (Built this machine to generate overtwisted SMA yarns and count the twist)
- Developing an SMA stent to insert in LV of patients with HFpEF
- Modified the Scoliosis Brace Straps using Shape Memory Alloys (Incorporated SMA textile/Auxetic structure to enhance user comfort and add a degree of freedom)
- Invented a bio-inspired robotic arm capable of real-time human motion replication, integrating SMA wires and springs for enhanced, lifelike grip response; designed an antagonistic actuation mechanism synced with user movements using EMG and IMU sensors and microcontroller programming for motion tracking and control

#### Product Design Innovation Lab

- Innovated from concept to prototype of a bubble maker toy for kids at the age between 3-8 years old as the project for product design innovation lab (This research integrated comprehensive user and market insights, concluding with a playsentation, a theatrical approach to demonstrating the product through a scripted performance)

#### New Product Design & Business Development (NPDBD)

- Designed and prototype a medical device, including market analysis, VOC, and business plan development
- Conducted end-to-end design processes, from sketching and CAD to manufacturing and product launch strategies.

## Work Experience

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### Startup- Exoskeleton Chair, (ISTA ARSH GAAM)

2019 - 2022

Founder and the Head engineer

- Primary Project: Developed a wearable exoskeleton chair to assist workers and surgeons by reducing physical strain during prolonged activities
- Managed a team of four part-time employers in different range of age and sex.
- Established the company, registered the brand name, secured the necessary certifications, and filled tax forms.

Consulted on the following projects:

- Developed a model for a humanoid robot to interact with children undergoing cancer treatment, incorporating emotional and functional support features.
- Developed a mechatronic system to measure tire longitudinal slippage during braking for enhanced safety.
- Conducted simulations and analyses for an F1 automobile suspension system.

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## Key Skills

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- **Programming:** MATLAB
- **Engineering Software:** Abaqus, SolidWorks, Onshape
- **Manufacturing:** CNC machining, laser cutting, 3D printing, rolling, tensile test(Instron), Dynamic Mechanical Analysis (DMA). manual lathe machining, yarn and fabric manufacturing, textile engineering and actuation, knitting and auxetic textiles, smart fiber integration, SEM, thermal processing, material and structure characterization, differential scanning calorimetry (DSC), light microscopy, polishing
- **General Software:** Photoshop, Illustrator, After Effects, KeyShot, Microsoft Office
- **Other Technical Skills:** Additive manufacturing, finite element analysis (FEA), EMG, research and development, rapid prototyping, industrial collaboration, design of experiments (DOE), Nitinol design, system design, shape memory alloy (SMA) design, teaching and mentoring, testing and planning, critical thinking, scientific documentation (including patents), SMA modeling

## Leadership & Mentoring

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Fall 2023-Present

### Teaching Assistant

ME 5241: Computer-Aided Engineering

ME 5223: Materials in Design

ME 3221 Lab: Fundamental of Design & Manufacturing

- Class support, and guiding students in material analysis and Granta EduPack software
- Guided students in hands-on design and manufacturing labs, fostering critical thinking and problem-solving skills

### Research Mentoring

July 2024 - Present

- Mentoring MSc and BS student in their projects in data gathering, analysis and experimental setup.

### Student Board Member

July 2024 - Present

ASM Shape Memory and Superelastic Technologies

- Leading a team for organizing workshops, and a conference in Smart materials.

### CAS MART Student Design Challenge

Sep 2025 - Present

- Served as mentor coordinator, facilitating technical milestone reviews and ensuring smooth collaboration between student teams and industry/academic mentors

## Publications and Presentations

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- Charles A. Weinberg, **Mohammad Reza Farahani**, et. al., Microfilament Over-Twisted Coiled Yarn Artificial Muscles and Actuating Textiles, Advanced Robotics Research, submitted in December 2025
- **Farahani, M. R.**, and S. Khodaygan. Minimization of Non-repeatable Runout (NRRO) in High-Speed Spindle Bearings. No. 2021-01-5023. SAE Technical Paper, 2021 .
- **Farahani, M. R.**, and J. Abel, "Design Optimization of Superelastic Niti Yarns for Energy-Absorbing Textiles", ASME SMASIS 2025 conference, Missouri, USA (Abstract and oral presentation)
- **Farahani, M. R.**, and J. Abel, "Optimization of NiTi Microfilament Yarns", ASME SMASIS 2024 conference, Atlanta, USA (Abstract and oral presentation)
- **Farahani, M. R.**, and S. Khodaygan, "Optimal Design of the HSS bearings to Minimize the Repeatable and Non-Repeatable Runout", ISME 2018 Conference, Semnan, Iran . (Abstract and poster presentation)
- S. Khodaygan and, **M. R. Farahani**, "Optimal Design of the Fluid Dynamic Bearings to Minimize the Non-Repeatable Runout", (Ready to submit).

## Honors and Awards

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- **Interdisciplinary Doctoral Fellowship (IDF)** for the 2026-27 Academic Year
- **Mechanical Engineering Departmental Fellowship** for graduate studies, University of Minnesota, January 2023
- **M. R. Farahani**, "iHairCare, a haptic package to cut your own hair or remote hair styling", International Design competition of Braun Prize, 2018
- **Ranked** in the top 0.8% in the National University Entrance Exam for Master's program in Mechanical Engineering (2015) and in the top 0.3% in 2010
- **Scholarship** for graduate studies, September 2015 and undergraduate studies, September 2010