Masoud Naghdi, PhD

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Research Engineer

Highly motivated, customer-oriented, and hardworking professional with gained knowledge in research and development, as well as wave propagation analysis and simulation, acoustics systems, microfluidic conceptual design, administrative support, team-based learning, and methodology for design. Proven success in utilizing multidisciplinary engineering knowledge and implementing problem-solving approaches with hands-on experience in 3D printing technology, steel industries, signal analysis, and manufacturing processes.

Work Experience and Training

- **Visiting Assistant Professor,** New Mexico Institute of Mining and Technology, NM, USA, 2024 (August) - Present
  Focus: Research interest area on Piezoelectric Transducers, Tactile Sensing, Soft Robotic, Soft Sensory Systems
  Special Experience:
  I. *Dandelion bio-inspired robot:* 1. Thermal and CFD Analysis by COMSOL Multiphysics 2. Experimental Procedure for Numerical Validation 3. Introducing as a Conceptual Design for Space Exploration
  II. *3D Scanning Laser Vibrometer:* 1. Senior Participant in a Major Research Instrumentation (MRI) Proposal Submitted to NSF (Under Review) 2. Tactile Sensing in Gripping Robots 3. Optimization of the Sensor Reactions to the Surface Fluctuations.
- **Postdoctoral Research Associate,** University of North Texas, TX, USA, 2021 – 2024 (July)
  Focus: Piezoelectric Optimization; Crystal Orientation; Design of Pressure Sensors in a Harsh Environment; Simulation and FEM analysis of Surface Acoustic Waves
  Special Experience:
  I. *IDT Fabrication by Lithography*: 1. Physical Vapor Deposition 2. E-beam Evaporation to deposit (Additive Process) metal Film such as Gold or Chromium (Around 50 nm) on Desired Wafers (4×4 inch with 500 µm thickness) 3. Mask Design, Exposure Process for high resolution (around 1 µm IDT finger) 4. Liftoff Process 5. S11 (for resonators) and S21 (for transmitter/receiver transducers) for measuring surface acoustic wave (SAW) eigenfrequency signals.
  II. *SEM pictures:* 1. Preparing the Samples 2. On/Off Vacuum 3. Experienced in Setting the Device for the Optimum Resolution.
  III. *FEM Analysis in Multiphysics Software (COMSOL & MATLAB):* 1. Optimization of FEM analysis 2. Utilizing Multiphysics Analysis such as Electrostatic/Structural Analysis for Piezoelectric materials and Elastic Waves/Fluidic Analysis for measuring time of flight (ToF) of induced SAW in a fluidic medium such as cell management simulation 3. Developing the driving equations of multi-physical systems, for example, thermofluidic equations with acoustic equations for acoustic heat transfer 4. Using MATLAB and COMSOL through the Livelink module to feed COMSOL using the formulas and parameters calculated in MATLAB.
- **Visiting Scholar,** New Mexico Institute of Mining and Technology, NM, USA, 2021-2022
  Focus: Aerostructure Analysis; Bio-inspirational drones; Undergrad/Graduate Student Project Management.
  Special Experience:
  I. *Aero structural conceptual design:* 1. Brainstorm and Effective Observation (literature review, documentary movies, sharing ideas in a group meeting, etc) 2. How to bring the conceptual idea into a practical design 3. Creating CAD/CAM files for Simulation Analysis 4. Utilizing Fluid-Structural Analysis by COMSOL and MATLAB (including the driving equations, boundary conditions, simplifications in the analytical model, etc.) 4. For example, prototype Fabrication for Experimental Analysis in the wind Tunnel 5. Modifying the FEM model and verifying the numerical results
  II. *Bio-inspired ideas for interplanetary robots and drones:* 1. New climbing and movement methods based on observing animals such as red sea Urchin, green Greco, orb web spider, and jellyfish. 2. Simulation of their movement with COMSOL with fluid-structure interaction and PDE boundary conditions. 3. The designed

robots were optimized in their geometries to be compatible with Autonomous Robotic Exploration Systems (ARES) in interplanetary explorations such as caves inside Mars, tunnels on Venus, or volcanic environments on Earth. 4. Prototype fabrication of the model with talented students for robotic competitions.

III. *Student Project Management:* 1. Student project management for an optimized timetable, outlines, and budgets. 2. Encouraging students to follow their fresh ideas and prepare them to bring their ideas with details such as CAD files, engineering analysis, research plan, and project milestones 3. Great experience in working with multicultural people with different research interests 4. Guiding students to prepare their projects and meet the requirements to participate in NASA Minds and Lunatic robots competitions.

- **Teacher Assistant,** University of Mississippi, USA, 2016-2021
  Focus: Nonreciprocity in Acoustics, Actuating Systems Using Liquid Metal (Galinstan),
  Special Experience:

  I. *Nonreciprocal Analysis:* 1. Providing the idea of Coriolis acceleration term is the source of nonreciprocity in acoustic. 2. The cross product appearing in the driving equations was shown as the nonreciprocity reason. 3. Based on the PDE simulation of acoustic fluidic equations by COMSOL, the best device to break reciprocity should have circular fluidic motion. 3. The advantage of the nonreciprocity in acoustic is that it can be used in full-duplex sonar communication systems. 4. The PDE simulation by COMSOL utilizing Green`s identity theorem was novel in our project.

  II. *Novel Idea in Liquid Metal (Galinstan):* 1. Utilizing liquid metal channels acting as conducting wires was the novelty of this project. 2. The flexibility and miniaturability were the main advantages of the new actuating system. 3. Our proposed actuating system was a good candidate for being in lab-on-a-chip systems. 4. The new actuator flexibility was compatible with applying bioimplant devices in medicine and biological systems.

  III. *Stereolithography (SLA) 3D Printing Experience:* 1. Designing the parts in SolidWorks or CATIA and importing them into the 3D printer software. 2. Maintenance, troubleshooting, tank inspection, and supervising the 3D printing projects. 3. Fabrication of 3d printed file with a resolution of 50 micrometers required for the micro-actuators. 4. The responsibility of purchasing the photo materials, disposal items, tanks, laser inspections, and all maintenance responsibilities is based on the instruction manuals. 5. Proving the courses for the students working with the 3D printer, managing their designs, and supervising the printing process.

Training

- **Introduction to Electro-Hydraulics**, FESTO didactic (Solenoid Valves, Electrical Switches, and Circuits), 40 hours.
- **Introduction to Proportional Hydraulics**, FESTO didactic (Proportional Hydraulic Valves: Characteristics, Adjustment, and Industrial Applications), 40 hours.
- **Maintenance of Hydraulics Equipment and Systems**, FESTO didactic (Principles of Maintenance in Hydraulic Systems), 40 hours.
- **Introduction to Hydraulics, FESTO didactic** (Principles of Designing Hydraulic Systems, Hydraulic Oil Maintenance, and Industrial Applications), 40 hours.

Job Skills

- *Sustaining support for integrated circuit or semiconductor processes:* My experience in SAW piezoelectricity can be helpful.
- *Improving, sustaining, and co-developing processes to meet quality, reliability, cost, yield, productivity and manufacturability requirements:* my experience in IDT fabrication, lithography, stereolithography 3D printing, and Numerical simulation are great to meet the requirements.
- *Innovating, problem solving, supporting development, and continuously improving equipment and processes using experimental design and statistical methods:* managing students' projects related to conceptual bio-inspirational designs in including simulation FEM model analysis, are valuable skills for this part.

- *Provide process and equipment specification feedback, applying principles for design of Experiments and data analysis, planning and documentation of improvements through the spec/Best Known Method (BKM):* My previous Ph.D. project in nonreciprocity and liquid metal in actuators, including my current job in fabrication of SAW wearable sensors are great to meet this requirement.
- *Developing solutions to problems utilizing formal education, statistical knowledge, and problem-solving tools:* My valuable experience in managing students in their bio-inspirational projects is very helpful.
- *Self-initiative, leadership, strategic shift planning, coaching, and supporting the development of a technical team:* As a designer working on the optimization of wearable sensors, I have learned much valuable knowledge.
- *Successfully participated in a highly matrix environment managing resources and timelines, as well as proven stakeholder management:* During my postdoctoral research position in Texas and New Mexico, I have learned a lot about working in a multicultural environment and multidisciplinary projects.
- *Flexibility in changing priorities and responsibilities to support business needs:* As a postdoctoral researcher at the University of North Texas, I have had a responsibility to have a meeting with the project sponsors to meet their requirements in every step of the project.
- *Tolerance for ambiguity in a fast paced, constantly changing product roadmap environment:* my technical abilities allow me to change and adapt the new expectations and goals in any part of the project progress.
- *Action-oriented by influencing, communication skills and work independently:* I have learnt how to communicate by Zoom meeting, in person meeting, write proposals, write papers and submit them to the well reputed journals, and make an effective communication with other technical people from other faculties.

Education and Academic Experience

- **Google Scholar:** https://scholar.google.com/citations?user=4wyxGGgAAAAJ&hl=en ; **Citations**: 32 (Since 2019)

- **Ph.D. in Engineering Science, Sep 2016 -Aug 2021**
  Department of Mechanical Engineering – the University of Mississippi, University, MS, USA
  Ph.D.'s Dissertation Title: "Nonreciprocity Applications in Acoustics and Microfluidic Systems,"
  Focus: Nonreciprocity in acoustics, Numerical and analytical explanation of the nonreciprocity source in the driving equations using Green`s identity theorem, The cross product due to Coriolis acceleration appears due to circular fluidic motion of the acoustic medium, expansion of nonreciprocity idea in fluidic systems, Fabrication of a flexible actuating system using liquid metal (Galinstan), the Faraday current force law is another nonreciprocal mechanism used in this dissertation, the novel idea in creating a flexible and miniaturable design of a micropump was another focus of this dissertation

- **Master of Science in Mechanical Engineering, Sep 2011 - Sep 2013**
  Department of Mechanical Engineering - Isfahan University of Technology (IUT), Isfahan, Iran
  Master's Thesis Title: "Analytical Measurement of Welding Residual Stress Using Critically Refracted Longitudinal (Lcr) Wave Technique,"
  Focus: Utilizing Lcr waves as a nondestructive test (NDT) in the evaluation of residual stresses in the weldments, Utilizing the Taguchi method as a DOE to optimize the welding parameters, lowering the final residual stresses such as pulse duration, lower and upper temperature, pulse time duration, and current of a TIG welding process by an automated welding machine.

- **Bachelor of Science in Mechanical Engineering, Sep 2003 - May 2008**
  Department of Mechanical Engineering – Imam Khomeini International University (IKIU), Qazvin, Iran
  Bachelor's Thesis: "Simulation of Tensions Due to Shocking Loadings in Pressure Vessels,"
  Focus: Simulation of a cylinder with a shocking wave source inside the tank, the optimization of the cylinder tank such as thickness, length, and diameter of the pressure vessels based on the frequency and intensity of a shocking wave inside the vessel.