

Monan Ma | CV

Boston, MA – last updated: December 29, 2025

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Research Specialization: nanomechanical sensors, nonlinear dynamics, simulations

- Experimental skills include sensitive optical and electrical metrology, and nanofabrication techniques. Extensive computational expertise in finite-element simulations.

Education

Boston University

Ph.D. candidate in Mechanical Engineering

GPA: 4.0/4.0

Boston, MA

09/2021 - 05/2026

Stony Brook University

M.Sc. and B.Eng. in Mechanical Engineering, minor: Music

GPA: 3.83/4.00, Magna Cum Laude

Stony Brook, NY

09/2014–05/2019

Experience

Boston University

Doctoral Research Fellow, Advisor: Prof. Kamil Ekinci

Boston, MA

09/2021 - present

- **Experimental research:** nonlinear nanomechanics and sensor physics
 - Built ultrasensitive optical and electrical detectors to interrogate nanoelectromechanical systems' (NEMS) response under deterministic, stochastic and environmental perturbations
 - Characterized nonlinear dynamics for the improvement of NEMS-based sensing applications
 - Electrical actuation and detection of 2D membrane vibrations using surface acoustic waves
- **Computational research:** finite-element modeling, physics-informed machine learning
 - Developed and experimentally validated a 3D model in COMSOL® to fully capture the physics of electrothermal transducers, allowing for the estimation of transduction efficiency in various surrounding media
 - Adapted a data-driven technique to uncover the governing laws of nonlinear oscillators from experimental data
- **Fabrication techniques:** additive microfabrication and semiconductor clean room facilities
 - Two-photon polymerization (2PP) using Nanoscribe PPGT2®
 - Maskless photolithography, thin-film e-beam metal deposition, chemical etching, wire bonding

Aramco Americas Research Center

Graduate Intern in the Sensor Development Team

Houston, TX

07/2025 - 09/2025

- Developed two independent sensors for real-time **monitoring of non-Newtonian fluids in harsh conditions**
- Sensor 1 is an established device currently deployed by Aramco, but requires improved precision and automation
 - Built a robust closed-loop control system that tracks fluid properties in real time using a digital lock-in amplifier, phase-locked loop, and automatic gain control
 - Developed test scripts in embedded software that enabled advanced fluid measurements previously deemed inaccessible
 - Achieved full system autonomy with approximately 10× faster sensing speed and 5× higher precision
- Sensor 2 is a novel device in its feasibility study stage
 - Performed simulations in Matlab to calculate the projected sensitivity and dynamic range of an existing prototype
 - Improved the sensor performance by adjusting the geometry of moving parts and motor specifications, collaborated with the fabrication team to 3-D print the new prototype, and achieved state-of-the-art performance

Teaching

Boston University

Graduate Student Teacher, Mechanical Engineering

Boston, MA

09/2022 - 05/2023

- Fluid Mechanics (Spring 2023): delivered a lecture on numerical simulations and graded the final project on modeling fluid-structure interactions and the Stokes' second problem
- Statics (Fall 2022): co-led and graded the experimental bridge design project

State University of New York (SUNY)

Visiting Assistant Professor, Mechanical Engineering Technology

Farmingdale, NY

08/2019 - 09/2020

- Primary instructor for teaching Thermodynamics, Engineering Dynamics, Statics, and CAD Design for a total of ~ 100 undergraduate students over one academic year
- Teaching reviews available at: <https://www.monan-ma.com/teaching>

Awards and Stipends

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|---|-----------|
| BU Engineering Portfolio (Website) Competition - Best Graduate Student Runner Up | 2025 |
| BU.Nano Cross-Disciplinary Fellowship: \$38,250 | 2022-2024 |
| BU Nanotechnology Innovation Center Research Travel Grant: \$1,500 | 2024 |
| MIT NT'24 Nanotechnology Conference Travel Grant: \$525 | 2024 |
| 3MT® Three-Minute Thesis Competition Finalist | 2023 |
| BU Graduate Student Organization Executive Board Service Award: \$250 | 2023 |
| BU Mechanical Engineering Departmental Distinguished Fellowship: \$36,782 | 2021-2022 |
| NCEES Fundamentals of Mechanical Engineering Certification, ID: 18-286-61 | 2018 |
| Stony Brook Strategic Partnership for Industrial Resurgence (SPIR) Research Scholarship: ~\$7,500 | 2017 |

Journal Publications (* = under review, † = in preparation)

- 8.† **M. Ma**, N. W. Welles, C. Yanik, I. I. Kaya, M. R. Paul and K. L. Ekinci, "High-order Moments of a Fluctuating Nanomechanical Duffing Resonator."
- 7.* W.G.Jiang, **M. Ma**, H. Gress, K. L. Ekinci, and M. Gonzalez, "A Dual NEMS Sensor for Nanomechanical Hydrogen Sensing," *IEEE Sensors*, 2025.
6. N.W.Welles, **M. Ma**, K. L. Ekinci, and M. R. Paul, "Theoretical Modeling of the Dynamic Range of an Elastic Nanobeam under Tension with a Geometric Nonlinearity," *J. Appl. Phys.*, 2025.
5. **M. Ma**, N. W. Welles, C. Yanik, I. I. Kaya, O. Svitelskiy, M. R. Paul and K. L. Ekinci, "Mode Dependent Scaling of Nonlinearities in a NEMS Resonator," *Appl. Phys. Lett.*, 2024.
4. **M. Ma** and K. L. Ekinci, "Electrothermal Actuation of NEMS Resonators: Modeling and Experimental Validation," *J. Appl. Phys.*, 2023.
3. Ti C., G. McDaniel, A. Liem, H. Gress, **M. Ma**, S. Kyong, O. Svitelskiy, C. Yanik, I. I. Kaya, M. S. Hanay, M. Gonzalez, and K. L. Ekinci, "Dynamics of NEMS Resonators across Dissipation Limits," *Appl. Phys. Lett.*, 2022.
2. Solovyov, V., S. Rabbani, **M. Ma**, Z. Mendleson, Z. Wang, A. Polyanskii, and P. Farrell, "Electromechanical Properties of 1-mm-Wide Superconducting Cables Comprised of Exfoliated YBCO Filaments," *IEEE Trans. Appl. Supercond.*, 2019.
1. Solovyov, V., S. Rabbani, **M. Ma**, Z. Mendleson, T. Haugan, and P. Farrell, "Performance of Layer Wound Epoxy Impregnated Coils Made from Multi-filamentary Cable of Exfoliated YBCO," *Supercond. Sci. Technol.*, 2019.

Conference and Internal Talks

Talk: "Development of sensor platforms for real-time rheology monitoring of drilling fluids," *Aramco Research Center, Houston, TX, 09/2025.*

Talk: "Nonlinearity problem and big data solution in nanoscale sensors and devices," *Gordon College Physics Department Colloquium Seminar, Wenham, MA, 12/2024.*

Poster: "Electrothermal actuation of nanoscale transducers," *COMSOL Conference, Burlington, MA, 10/2024.*

Talk: "Nonlinearities in a NEMS Resonator: Mode-Dependent Scaling," *19th International Workshop on Nanomechanical Sensing, Vienna, Austria, 06/2024.*

Poster: "Big data in nano sensors," *BU.Nano Center Annual Symposium, Boston, MA, 11/2023.*

Talk: "Integration of machine learning techniques for nanoscale systems and classical noise suppression," *MIT AeroAstro, Cambridge, MA, 01/2022. Hosting faculty: Prof. Chuchu Fan*

Talk: "Research v. Industry: pathways to finding your niche," *Gordon College Physics Department Colloquium Seminar, Wenham, MA, 01/2022.*

Media Coverage

"Monan Ma: Making Big Waves with Nanotechnology in the Ekinci Lab," BU Photonics News, 2024. [\[Link\]](#)

Student Research Mentorship

○ Graduate students

- Ali Tarlani Beris, Spring 2023

Project: *Resonance tracking of quartz tuning forks using lock-in amplifiers*

- Eli Forstadt, Fall 2022

Project: *Building a high-frequency phase-locked loop using field-programmable gate arrays*

○ Undergraduate students

- Ricardo Gonzales, REU program in summer 2025, currently a senior at UC Davis

Project: *Physics-informed machine learning for studying nonlinear dynamics in NEMS*

- Zhiwen Liu, summer 2025, currently a junior at BU

Project: *Fabrication and transducer integration on a 2-D membrane*

- Vlad Pyltsov, UROP program in summer 2022, currently a Ph.D. student at Columbia University

Project: *Spectral measurements of an electromechanical resonator in laminar air flow*

Leadership and Service

Journal Referee: Nano Letters (×4), Phys. Rev. B (×2), Phys. Rev. Appl. (×2)

Outreach: Upward Bound Math Science program for first-generation college-bound high school students

Vice President: BU Graduate Student Organization

International Student Ambassador: Stony Brook U Admissions

Technical Tools

Software: COMSOL, Matlab, Python, C++, JavaScript, Verilog, LabVIEW, L^AT_EX, Microsoft Office, Origin Pro

Hardware: Lock-in amplifiers, arbitrary waveform generators, oscilloscopes, spectrum and network analyzers, DC and EC motors, piezoelectric actuators, optical detection systems, and high-power lasers

Testing: Ultra-high vacuum (UHV) systems, cryogenic systems