BAHA ERIM UZUNOGLU

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EDUCATION

Ph.D. in Electrical and Electronics Engineering,
North Carolina State University, Raleigh — *August 2022 - Present*

MS in Electrical and Electronics Engineering,
Bilkent University, Ankara — *September 2019 – July 2022*

BS in Electrical and Electronics Engineering,
Bogazici University, Istanbul — *September 2014 - June 2019*

Exchange Program BS Electrical and Electronics Engineering,
University of Melbourne, Melbourne — *July 2016 – November 2016*

RELEVANT COURSEWORK

Electrical	Power Management Integrated Circuits, Analog Electronics, Neural Interface Engineering, CMOS VLSI Design, Electroacoustic Transduction, Nanoscale Fabrication Technologies for Semiconductors, Nanoengineering, and Nanodevices, Medical Instruments.
Mechanical	MEMS and Micro Systems.
Material	Micro and Nanofabrication, Applications of Microfluidics and Nanofluidics.

RESEARCH EXPERIENCE

Graduate Researcher — NC State University, Raleigh
Advisor: *Asst. Prof. Amay Bandodkar* — *August 2022 – Present*

- **Wearable sensing and haptic communication:** Co-conceptualized and developed a wearable platform integrating gas, particulate, and aqueous chemical sensing with six target-specific vibrotactile codes; first author of the resulting *Device* publication (2026).
- Co-developed a PVDF electronic-skin receiver that decodes vibration patterns from eccentric rotating mass actuators, enabling a quadrupedal robot to respond to environmental hazards. Contributed to actuator–skin interface characterization and built conformal housings using 3D printing and Ecoflex.
- **Low-power electronics and firmware:** Contributed to duty-cycled sensing and solar energy harvesting for approximately 24-hour operation under reported conditions. Implemented C/C++ firmware for sensor communication and low-power operation on MSP430, nRF52, and ESP32 platforms.
- Designed rigid and flexible PCBs with serpentine layouts, low-noise analog front ends, and programmable-gain stages for optical, haptic, electrochemical, and neural-interface circuits. Developed Python pipelines for filtering, FFT analysis, calibration, sensor fusion, and environmental compensation.
- **Neural recording hardware:** Contributed PCB design and benchtop electrical simulation experiments to carbon nanotube microelectrode arrays for cerebral-organoid electrophysiology, published in *npj Biosensing* (2026).
- **Optical and physiological instrumentation:** Built optical and colorimetric assay systems with controlled LED illumination, photodiode readout, and Python routines for intensity mapping and feature normalization. Prototyped an EMG muscle-contraction detector with filtering, envelope extraction, and onboard threshold logic.
- **Interdisciplinary research:** Collaborated with veterinarians, physicists, biologists, chemists, and medical doctors. Co-authored studies on water-powered wound dressings (2024) and moisture-activated batteries (2026), both published in *Science Advances*.

Graduate Researcher Bilkent University, Ankara
Advisor: *Asst. Prof. Erdinc Tatar* *July 2019 – July 2022*

- **MEMS gyroscope design and drift compensation:** Designed and tested a 3.2 mm vibrating ring gyroscope integrated with 16 capacitive stress sensors to measure on-chip stress and compensate long-term output drift.
- Evaluated zero-rate output over 16 days in mismatched mode and eight days in matched mode. The published stress-compensated stability reached 0.008 degrees/hour and 0.003 degrees/hour, respectively, at two-day averaging with no observed long-term drift.
- First-authored the resulting *Journal of Microelectromechanical Systems* article (2022); co-authored conference papers on disk-resonator vibration analysis (INERTIAL 2022) and stress effects on ring-gyroscope frequencies (MEMS 2023).

Undergraduate Researcher Bogazici University, Istanbul
Advisor: *Prof. Senol Mutlu* *September 2018 – June 2019*

- **Microfluidic instrumentation:** Built a stepper-motor syringe-pump platform for microfluidic chip testing, integrating the pump mechanism with a control unit and user interface.
- Adapted the platform for droplet generation in a microfluidic channel with a 250 μm radius.

TEACHING EXPERIENCE

Teaching Assistant
Bilkent University, Ankara *September 2019 - July 2022*

- **Fall 2019 - Spring 2022** - Assisted EEE 313 Electronic Circuit Design
  Responsible for revising and preparing new laboratory assignments, laboratory sessions, and grading.

NC State University, Raleigh NC *August 2022 - May 2023*

- **Fall 2022** - Assisted ECE 302 Microelectronics
  Responsible for laboratory sessions, course project supervision, grading, and tutoring.

PROFESSIONAL EXPERIENCE

Intern
Aselsan A.S. – Research and Development Department *06 August - 11 September 2018*

- Avionic Hardware System Design Department: PCB design for SPI and UART-based communication circuitry.

Siemens Healthineers - Customer Service Department *04 June - 03 July 2018*

- Customer Service Department: Big data analysis and project management for biomedical machinery and setup processes.

Arcelik A.S. - Research and Development Department *10 July - 05 August 2017*

- Human Machine Interface(HMI) Department: Hardware design of wireless powered Cap sense LED indicator for smart washing machines.

SKILLS

Computer Skills

- Programming: C, C++, Python, VHDL, Assembly, MATLAB
- Simulation: Comsol MultiPhyshcis Tool, Lumerical, Cadence, LTSpice
- Layout Design: Altium, Cadence, OrCAD
- Developer Tools: Arduino, Raspberry Pi
- Other: MS Office, LaTeX

Languages

- Turkish (native)
- English (advanced)

Fabrication

- Deposition
- Photolithography
- DRIE
- Wirebond

PUBLICATIONS

- **B. E. Uzunoglu**, O. Ojuade, K. Hepler, M. Aleem, R. Kaveti, K. Kathpalia, K. Su, B. Sahin, V. Misra, C. Dhong, L. C. Hsiao, and A. J. Bandodkar. "Multimodal, wearable sensors with tactile communication capabilities for human and robotic applications." *Device*, article 101245, published online July 24, 2026. DOI: 10.1016/j.device.2026.101245.
- R. Kaveti et al. (including **B. E. Uzunoglu**). "Safe, high-performance, moisture-activated batteries for powering next-generation Internet-of-Things devices." *Science Advances*, article eaee2065, 2026. DOI: 10.1126/sciadv.aee2065.
- N. Mishra, R. Kaveti, P. Liu, **B. E. Uzunoglu**, et al. "Carbon nanotube microelectrode arrays enable scalable and accessible electrophysiological recordings of cerebral organoids." *npj Biosensing*, vol. 3, article 20, 2026. DOI: 10.1038/s44328-026-00088-9.
- R. Kaveti et al. (including **B. E. Uzunoglu**). "Water-powered, electronics-free dressings that electrically stimulate wounds for rapid wound closure." *Science Advances*, vol. 10, no. 32, article eado7538, 2024. DOI: 10.1126/sciadv.ado7538.
- M. Hosseini-Pishrobat, **B. E. Uzunoglu**, and E. Tatar. "Modeling Stress Effects on Frequencies of a MEMS Ring Gyroscope." *2023 IEEE 36th International Conference on Micro Electro Mechanical Systems (MEMS)*, pp. 869–872, 2023. DOI: 10.1109/MEMS49605.2023.10052439.
- **B. E. Uzunoglu**, D. Erkan, and E. Tatar. "A Ring Gyroscope With On-Chip Capacitive Stress Compensation." *Journal of Microelectromechanical Systems*, vol. 31, no. 5, pp. 741–752, 2022. DOI: 10.1109/JMEMS.2022.3197341.
- M. Hosseini-Pishrobat, **B. E. Uzunoglu**, D. Erkan, and E. Tatar. "An Analtical Model for Vibration Analysis of Disk Resonator Gyroscopes." *2022 IEEE International Symposium on Inertial Sensors and Systems (INERTIAL)*, pp. 1–4, 2022. DOI: 10.1109/INERTIAL53425.2022.9787727.
- **B. E. Uzunoglu**. "A MEMS vibrating ring gyroscope with on-chip capacitive stress sensors for drift compensation." Master's thesis, Department of Electrical and Electronics Engineering, Bilkent University, Ankara, Turkey, 2022.

MENTORING

- **Undergraduate students, North Carolina State University:** Krish Kathpalia and Kyle Su.
- **High school student:** Ketav Karthikeyan.

POSTER PRESENTATIONS

- "Multimodal Haptic Feedback Device for Environment Monitoring." ASSIST Industry Day, 2025.

CONFERENCE TALKS

- 29th Annual TechConnect World Innovation Conference and Expo.

ACADEMIC ACHIEVEMENTS

- Graduated with Honor Reward from Bogazici University (2019).
- Fellowship from The National Nanotechnology Research Center of Turkey (UNAM) for Master's studies (2019 - 2022).
- Ranked 410^{th} among over two million participants in Turkey's national university entrance exam.