Xiangbo Cai

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My research interests include Non-Destructive Evaluation (NDE) sensor design (Magnetic Flux Leakage, Capacitive, Eddy Current Testing), embedded intelligence sensing systems, and machine learning/deep learning-assisted NDE methods, with a specific focus on developing a multi-modal foundation model.

EDUCATION

Michigan State University, Honors College Expected May 2027

Bachelor of Science, Electrical Engineering & Computer Engineering ***GPA**: 3.93/4.00*

PUBLICATION

[1] L. Peng, **X. Cai**, N. Zhang, Z. Li, and Y. Deng, "*In-line Inspection for Ferromagnetic Bent Pipe Using 3D-printed Flexible MFL Sensor Array*," IEEE Transactions on Instrumentation and Measurement, under revision.

RESEARCH EXPERIENCE

Non-destructive Evaluation Laboratory Oct 2023 – Present

Research Assistant, Winter Research Scholar *Advisor: Prof. Yiming Deng*

• Developed an innovative flexible Magnetic Flux Leakage (MFL) method, resulting in higher resolution (<1.5mm defect detection) and flexible sensing capability on curved pipelines

• Engineered a multi-channel sensing electronics system with circuit schematic design, PCB design, and embedded C programming in STM32, enabling real-time data acquisition through Hall sensors

• Designed and 3D-modeled connector in the MFL system, using SolidWorks and OnShape, creating a flexible joint capable of navigating 15+ different geometrical pipeline shapes

• Developing a multi-modal foundation model for NDE to integrate diverse sensor inputs and enhance defect detection capabilities.

Edge Intelligence and Networking (EIN) Lab Aug 2024 – Apr 2025

Research Assistant, Wielenga Research Scholar *Advisor: Prof. Zhichao Cao*

• Implemented Bluetooth Low Energy (BLE) connectivity on the nRF52840 by programming in C++, achieving BLE communication between iOS, Android, and other compatible devices

• Applied Python noise cancellation algorithms and signal processing to PDM data, resulting in >15% less noise in recorded audio and improved system stability compared to initial prototype

Smart Sensing Laboratory Jan 2025 – May 2025

Research Assistant

• Processed 2,000+ agricultural images in Roboflow by performing data augmentation and annotation, creating high-quality datasets for training deep learning models in TensorFlow and PyTorch

• Constructed feedback control systems for an agricultural application by tuning PID parameters in MATLAB/Simulink, producing a 20% improvement in transient response

TEACHING & MENTORING EXPERIENCE

Fall 2024 – MTH103 (College Algebra)

- Instructed a freshman-level math course, delivering two lectures weekly to 45 students. Provided 2 hours of weekly tutoring at the Math Learning Center (MLC) and graded exams and quizzes.

Fall 2025 – ECE202 (Circuits & Systems II)

- A sophomore-level electrical engineering course, grading homework assignments and exams

Fall 2025 – Honors College Academic Peer Mentor

- Providing professional academic support for first- and second- year honors college students

Spring 2026 – ECE480 (Senior Design)

- A senior-level electrical engineering course, grading student homework and organizing class

HONORS & AWARDS

Tau Beta Pi, National Engineering Honors Society, 2025
Winter Research Scholar, Michigan State University Honors College, 2025 – 2026
Wielenga Research Scholar, Michigan State University Honors College, 2024 – 2025
Dean's Showcase of Stars, MSU College of Engineering, 2024 & 2025
Think Outside the Pizza Box Winner, GrizzHacks 6, 2024
Dean's List, All semesters, 2023 – Present

TECHNICAL SKILLS

Programming Languages: Python, C, C++, ARM Assembly, MATLAB/Simulink, System Verilog
Hardware: nRF52840, ESP32, STM32, BLE 5.x, RTOS, UART/SPI/I²C, Raspberry Pi
Software: Altium Designer, LTspice, SolidWorks, Git, Linux, Vivado, Keil uVision, LaTeX

LANGUAGES

English
Mandarin Chinese