Michael Raba

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Featured Projects

Projects

- **1. Multichamber Muffler Design** (2023). Designed a multichamber muffler system with internal components including chambers, baffles, perforates, and fiberglass absorbents. Simulated acoustic performance using industry-standard tools and validated results against measured data.
  - **Tools Used**: **ANSYS 2023 (Acoustics Module)**, SIDLAB 5.1, (Verification of Model using 1d approximation)
  - Modeled transmission and insertion loss across 0–1000 Hz using fluid approximations
  - Created CAD-style schematics and component breakdowns for internal geometry
  - Compared simulated and measured acoustic data using Transmission Loss (TL) and Insertion Loss (IL) metrics
  - Published downloadable simulation files for reproducibility and benchmarking
- **2. Viscoplastic Modeling** (2023). Applied Anand's viscoplasticity model to simulate strain-rate and temperature-dependent behavior of solder alloys on microchip package. Forward Euler integration scheme in Python to solve constitutive equations and model stress evolution under thermal effects to verify Ansys model.
  - **Tools Used**: **ANSYS (nonlinear materials module)**, Python NumPy (Verificiation using Numerical Model)
  - **Material parameter fitting** based on experimental data
- **3. Electromagnetics Simulation: Finite Difference Time Domain — Navier Stokes Simulation** (2019). Calculates in 3D space location of a particle in a **magnetized fluid flow** using the Yee Scheme, using finite difference equations and staggered time-stepping.
- **4. MSc Project – POD Analysis of Turbulent Pipe Flow** (2023). Developed a MATLAB-based framework to analyze turbulent rotating pipe flow using Proper Orthogonal Decomposition (POD). Compared Classic and Snapshot POD methods to extract dominant energetic structures and reconstruct flow fields.
  - **Tools Used**: MATLAB, Python, C++, fortran2020, linux
  - Models produces simplified model from 5 Terabytes of data to enable better design decisions

Employment

Research Assistant — **University of Kentucky** — **2020 – 2023**

National Science Foundation (NSF) Research Assistant

- Poster Presentation at 2022 AIAA Aviation and Aeronautics Forum in Chicago, IL
- Collaboration with 11 PhD students at University of Maryland, College Park and University of Oxford

Teaching Assistant — **University of Kentucky** — **Fall 2020 & Spring 2023**

- Led course on Design of Experiments (DOE), (ME311 `Experimental Design II`), a senior level course covering Heat Transfer, Fluid Mechanics, Statics, Engineering Statistics and `R`; also taught `ME 330 Fluid Mechanics I` as an undergraduate and `ME 321 Thermodynamics II` as recitation leader in Fall 2020.

Wayfinding Assistant — **Chandler Medical Center** — **Fall 2019 – Spring 2020 and July 2023 – Present**

- Developed custom wayfinding map app to assist hospital visitors. Flask, Python, SQL

Education

Lexington, KY — **University of Kentucky** — **Fall 2015 – December 2023**

- BA in Mathematics, May 2019. In-major GPA: 3.6.
- MSc in Mechanical and Aerospace Engineering, December 2023 (Expected). GPA: 3.3