

Amit K Singh

CONTACT INFORMATION

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EDUCATION

Pennsylvania State University

University Park, PA

PhD, Mechanical Engineering

Est. 9/2026

- Thesis: Development and Deployment of 4D Emission Tomography for Reacting Waves
- Advisor: Samuel J Grauer
- GPA: 4.00

India Institute of Technology Kanpur

Kanpur, India

MTech, Aerospace Engineering

31/5/2018

- Thesis: Study of the Effect of Roughness on Gas-Surface Interactions
- Advisor: Rakesh Kumar Mathpal
- GPA: 3.90

BTech, Aerospace Engineering

1/6/2017

- GPA: 3.44, (top 5%)

AWARDS & SCHOLARSHIPS

Academic Excellence Award in two consecutive years
Indian Institute of Technology, Kanpur India

2015, 2016

Merit-cum Means (MCM) Scholarship
Indian Institute of Technology, Kanpur India

2015-2017

Boeing Technical Internship Program
Boeing International Corporation India Private Limited

2016

RESEARCH PROJECTS

Pennsylvania State University, University Park, PA

4D Emission Tomography for Reacting Waves

1/2024–Present

- Developed neural-implicit framework for 4D tomographic imaging of detonation waves
- Developed observation operator for chemiluminescence that accounts for depth-of-field effects
- Implemented efficient sampling method for forward and inverse chemiluminescence imaging
- Validated framework using synthetic chemiluminescence images of a turbulent CH₄/air flame
- Developed operator for refraction correction due to curved domain in detonation experiments

Camera Calibration Framework for Multi-Camera Imaging with Refractive Liners 9/2024–Present

- Implemented two-stage calibration framework for multi-camera calibration system
- Calibrated 11-camera facility for background oriented schlieren (BOS) tomography
- Extended the framework for refraction correction to integrate NIRT with experiments

Data Assimilation Framework for Combustion

1/2023–9/2024

- Developed PINN data assimilation framework for spectral emissions from water vapor
- Modeled physics loss in 1D dimensional flame with single-step chemistry based on CANTERA
- Included mixture averaged model to estimate transport properties including thermal conductivity, mixture diffusivity and viscosity

Aggregate Loss Data Assimilation for Supersonic BOS 5/2022–12/2023

- Developed optimization-based data assimilation framework for BOS
- Implemented compressible FV-CFD solver in differentiable programming environment

Predictive Modeling of Cardiovascular Health: Leveraging Machine Learning for Early Detection and Prevention of Heart Diseases 8/2023–12/2023

- Developed a hybrid Convolutional Recurrent Neural Network (CRNN) in PyTorch for classifying 7 types of cardiac arrhythmias with 12-lead ECG database of 10k patients
- Implemented a novel architecture combining CNN blocks with skip connections and bidirectional LSTM layers
- Achieved 90.14 accuracy using an ensemble model with probability-based voting
- Demonstrated improved performance by using multi-lead ECG data compared to single-lead approaches

Indian Institute of Science, Bengaluru, India

Synchronization Dynamics in a Rotating Swirl Combustor 11/2018–3/2020

- Studied thermoacoustic instability mitigation in an unstable laboratory scale combustor, using a robust approach of a rotating swirler
- Involved in performing combustion experiments with chemiluminescence Imaging

Indian Institute of Technology Kanpur, Kanpur, India

Study of the Effect of Roughness on Gas-Surface Interactions 7/2017–6/2018

- Characterized surface roughness by incorporating protrusions of various geometrical shapes
- Applied the Direct Simulation Monte Carlo (DSMC) method to evaluate the effective Tangential Momentum Accommodation Coefficient (TMAC) considering roughness effects
- Developed an empirical model linking effective TMAC to roughness parameters using supervised machine-learning techniques

Experimental Study of Single Expansion Ramp Nozzle with Bleed System 1/2017–5/2017

- Analyzed flow separation phenomena and SERN performance across diverse design parameters
- Utilized Schlieren Technique for flow visualization to identify flow separation locations on the ramp caused by over-expansion

Boeing International Corporation India Private Limited, Hyderabad, India

Structural Health Monitoring of Aircraft Components 5/2016–6/2016

- Performed study on “Structural Health Monitoring of Aircrafts”, particularly focusing on the effect of delamination on the vibration characteristics of the composite plates
- Simulated finite element models of wing panel and fuselage section in Nastran solver
- Analyzed vibration characteristics of models having delamination of different sizes

TEACHING
EXPERIENCE

TA Computational Tools (ME 330)	Penn State	Fall 2022
TA Introduction to Combustion (ME 430)	Penn State	Fall 2021
TA Experiments in Aerospace Engineering (AE 251)	IIT Kanpur	Spring 2017

JOURNAL
PUBLICATIONS

Published

J1. KK Kammara, R Kumar, **AK Singh**, and AK Chinnappan, “Systematic direct simulation Monte Carlo approach to characterize the effects of surface roughness on accommodation coefficients,” *Phys Rev Fluids* **4**, 123401 (2019). [doi:10.1103/PhysRevFluids.4.123401](https://doi.org/10.1103/PhysRevFluids.4.123401)

CONFERENCE
CONTRIBUTIONS

Papers

C3. **AK Singh**, JP Molnar, M Gomez, RT Fievisohn, and SJ Grauer, “Towards 4D emission tomography of reacting waves,” *AIAA SciTech 2025 Forum*, Orlando, FL, Jan 6–10, 2025.

- C2. RA Peck Cowles, JP Molnar, **AK Singh**, and SJ Grauer, “Tomographic background-oriented schlieren facility for buoyancy-driven flows and flames,” *AIAA SciTech 2025 Forum*, Orlando, FL, Jan 6–10, 2025.

Abstracts

- C1. **A Singh**, JP Molnar, SJ Grauer, and GS Sidharth, “Aggregate loss data assimilation (ALDA) for supersonic BOS,” *75th Annual Meeting of the APS Division of Fluid Dynamics*, Indianapolis, IN, Nov 20–22, 2022.