

curriculum vitae of  
**Mohit Kumar Tekriwal**  
PHD CANDIDATE · DEPARTMENT OF AEROSPACE ENGINEERING ·  
UNIVERSITY OF MICHIGAN, ANN ARBOR, 48109 ·

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## EDUCATION

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2018– present	<b>Ph.D.</b> in Aerospace engineering	UNIVERSITY OF MICHIGAN, ANN ARBOR
	I am working on the formal verification of numerical schemes. Numerical methods are used to obtain numerical solution of the mathematical models for physical systems. Therefore, my work is on using the state-of-the-art theorem prover and lightweight verification techniques to formally specify numerical errors and bound them, thereby providing guarantees on the accuracy of numerical methods.	
2018 – 2020	<b>M.Sc.</b> in Aerospace engineering (GPA: 3.85/4)	UNIVERSITY OF MICHIGAN, ANN ARBOR
2014 – 2018	<b>B.Tech</b> in Aerospace engineering (GPA: 9.0/10)	INDIAN INSTITUTE OF TECHNOLOGY, KANPUR, INDIA

## RESEARCH EXPERIENCE

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2018–Present	Formal Verification of Numerical schemes Advisor: Prof. Jean-Baptiste Jeannin, Dept. of Aerospace Engineering, University of Michigan <ul style="list-style-type: none"><li>• Learnt functionalities of Coq proof assistant</li><li>• Formally verified consistency of a 2nd order central finite difference scheme in Coq proof assistant</li><li>• Formalized the Lax–equivalence theorem (statement of convergence of finite difference schemes) in the Coq Proof assistant</li><li>• Formally verified stability of Forward in time and Central in Space (FTCS) scheme for 1D-heat diffusion equation</li><li>• Explored light weight verification techniques like Frama-C to carry verification at the code level</li></ul>
June 2021–August 2021	Certified approximation of Transcendental functions Advisor: Prof. Eva Darulova, formerly at MPI-SWS, currently at the University of Uppsala <ul style="list-style-type: none"><li>• Worked on formalization of the Remez algorithm for approximation of transcendental functions in HOL4 theorem prover</li><li>• Implemented the first version of certificate checker in a static analysis tool, Daisy</li><li>• Formalized the McLaurin series approximation of transcendental functions and root finding methods in HOL4 theorem prover</li></ul>
May 2017 – July 2017	Active Flow Control for Drag Reduction in wall bounded Turbulent Flows Mentor: Prof. Mitul Luhar, Dept. of Aerospace and Mechanical Engineering, University of Southern California, Los Angeles <ul style="list-style-type: none"><li>• Addressed challenges associated with feedback flow control that include development of an effective and robust control law, and development of small and reliable actuators</li><li>• Implemented Genetic Algorithm (GA) based techniques to find optimal values of PID control law constants that suppress energetic velocity modes and reduce drag in turbulent flows</li><li>• Fabricated a prototype of a piston-based actuator using 3-D printing</li><li>• Employed scotch-yoke mechanism in the actuator to convert rotary motion of the motor shaft to linear motion of the piston</li></ul>

Aug 2017 – May 2018

## Instability and receptivity studies in Lid Driven Cavity Problem

Mentor: Prof. Tapan K Sengupta, Dept. of Aerospace Engineering, Indian Institute of Technology, Kanpur, India

- Simulated and analyzed flow in a 2D Lid Driven Cavity
- Successfully obtained a narrow range of optimal excitation amplitude responsible for onset of temporal instabilities in the system for Reynolds number in the range: 8000 - 8660
- Carried Flow visualization studies and post processing using TecPlot
- Redrew bifurcation curve using vorticity time series data with respect to specific numerical method to obtain reported critical Reynolds number by other researchers
- Extended the exercise for 257 x 257 grid to finer grids: 513 x 513 and 1025 x 1025, and obtained similar results

## TEACHING EXPERIENCE

Fall-2019, Fall-2020

## Graduate Student Instructor

AEROSP 495: INTRODUCTION TO AEROSPACE COMPUTING

I was responsible for grading homework, take home examinations and conducting office hours. I was also in-charge of weekly labs for the course, and delivered a couple of lectures in the class.

Student feedback rating: 4.6/5.0

## PUBLICATIONS

## CONFERENCE AND JOURNAL PUBLICATIONS

1. V. K. Suman, Siva Viknesh S., **Mohit K. Tekriwal**, Swagata Bhaumik, Tapan K. Sengupta. Grid sensitivity and role of error in computing a lid-driven cavity problem. In *Phys. Rev. E* 99, 013305.
2. **Mohit K. Tekriwal**, Karthik Duraisamy, Jean-Baptiste Jeannin. A formal proof of the Lax equivalence theorem in finite difference schemes. In *13th NASA Formal Methods Symposium*, 2021.

## UNDER REVIEW

1. **Mohit K. Tekriwal**, Joshua Miller, Jean-Baptiste Jeannin. Formal verification of iterative convergence for numerical solutions of differential equations. In *Certified Programs and Proofs (CPP)*, 2022.

## HONORS

2021

## Max Plank research fellowship

Awarded the Max Plank research fellowship for summer research internship at the Max Plank Institute of Software systems(MPI-SWS)

2020

## PhD candidacy

Advanced to candidacy of the PhD program in Aerospace engineering

2018

## General Proficiency Medal

Awarded for the best academic performance in the graduating batch of Aerospace engineering

2018

## Proficiency Medal

Awarded for the best undergraduate Project in the graduating batch of Aerospace engineering department

2017

## SN Bose Scholarship

Selected for summer internship program in the United States of America. A total of 50 students from 78 reputed institutions in India, were selected for this award.

2016-2017

## Academic Excellence award

2014

## Kishore Vaigyanik Protsahan Yojna (KVPY) Fellowship

## SKILLS

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- Programming Languages: C, C++, JAVA, OCaml, Rust
- Software and Utilities: MATLAB, TecPlot, Coq Proof Assistant, HOL4 theorem prover, Frama-C, Microsoft office suite, AutoCad, SolidWorks, LabVIEW
- Operating System: Linux, Windows, Mac

## COURSEWORK

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- Inference, Estimation and Learning
- Data driven modeling of Complex systems
- Advanced Programming Languages
- Project Management and Consulting
- Linear Systems theory
- Non-linear Systems theory
- Computational Fluid Dynamics
- Differential equations
- Vector algebra
- Optimization methods in engineering applications
- Applied numerical methods
- Introduction to Finite Element methods
- Formal Verification of Software and Hardware systems
- Compiler Construction (ongoing)

## COURSE PROJECTS

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Fall 2019

Bayesian Games

AEROSP 740: Inference Estimation and Learning

- Carried literature survey on Bayesian games for adversarial machine learning
- Studied the relevance of Game theoretic approach in cyber-security applications

Winter 2020

Verification with Frama-C

EECS 590: Advanced Programming Languages

- Carried static analysis of C code using the Hoare Logic
- Motivation is to formally verify CFD solvers directly at the code level

## SERVICE TO THE SCIENTIFIC COMMUNITY

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Student Volunteer

Verification Mentoring Workshop, CAV 2020.

Reviewing

Artifact Evaluation committee, CAV 2021.

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## EXTRACURRICULAR ACTIVITIES

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April 2016–April 2017

Coordinator, Astronomy Club, IIT Kanpur

- Responsible for maintenance of OAAR (Observatory for Astronomical Research), fully automated 10 feet state-of-the-art computerized telescope
- Initiated and guided sophomore and freshman students on projects like auto focuser for obtaining sharp images and photometric studies using CCD camera
- Successfully organized inter college astronomy fest and inter IIT astronomy meet