

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 formal verification of numerical schemes. Numerical methods are used to obtain numerical solution of mathematical models for physical systems. Therefore, my work is based 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 the Coq proof assistant</li><li>• Formally verified consistency of a 2nd order central finite difference scheme in the 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>• Formally verified the convergence properties of classical iterative methods in Coq</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 a first version of the 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></ul>

- Fabricated a prototype of a piston-based actuator using 3-D printing
- Employed scotch-yoke mechanism in the actuator to convert rotary motion of the motor shaft to linear motion of the piston

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. *Submitted*.

## 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)

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)

## RELEVANT 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