

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	Ph.D. 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. To this end, I am working towards the goal of formalizing the approximation errors and build an end to end verifier that takes a numerical program and spit out any bugs or bad program executions that might affect the result, without actually running the program. This would save enormous times spent on simulating codes that are bound to blowup or fail.	
2018 – 2020	M.Sc. in Aerospace engineering (GPA: 3.85/4)	University of Michigan, Ann Arbor
2014 – 2018	B.Tech in Aerospace engineering (GPA: 9.0/10)	Indian Institute of Technology, Kanpur, India

## Publications

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### 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.

### Working papers

1. Formal Verification of the Weighted Mean Subsequence Reduced(W-MSR) algorithm for distributed controls.  
Investigators: Mohit K. Tekriwal, Avi Tachna-Fram, Jean-Baptiste Jeannin, Manos Kapristos, Dimitra Panagou
2. Certified approximation of transcendental functions  
Investigators: Heiko Becker, Mohit K. Tekriwal, Eva Darulova, Anastasia Volkova, Jean-Baptiste Jeannin

## 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></ul>

- Formalized the Lax–equivalence theorem (statement of convergence of finite difference schemes) in the Coq Proof assistant
- Formally verified the convergence properties of classical iterative methods in Coq
- Explored light weight verification techniques like Frama-C/VST to carry verification at the code level

June 2021–August 2021    Certified approximation of Transcendental functions  
 Advisor: Prof. Eva Darulova, formerly at MPI-SWS, currently at the University of Uppsala

- Worked on formalization of the Remez algorithm for approximation of transcendental functions in HOL4 theorem prover
- Implemented a first version of the certificate checker in a static analysis tool, Daisy
- Formalized the McLaurin series approximation of transcendental functions and root finding methods in HOL4 theorem prover

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

- Addressed challenges associated with feedback flow control that include development of an effective and robust control law, and development of small and reliable actuators
- 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
- 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

## Honors

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2021	Max Planck research fellowship Awarded the Max Planck research fellowship for summer research internship at the Max Planck 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)

## Course Projects

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Fall 2019	Bayesian Games AEROSP 740: Inference Estimation and Learning
	<ul style="list-style-type: none"> <li>• Carried literature survey on Bayesian games for adversarial machine learning</li> <li>• Studied the relevance of Game theoretic approach in cyber-security applications</li> </ul>

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

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### Service To The Scientific Community

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Student Volunteer

Verification Mentoring Workshop, CAV 2020.

Reviewing

Artifact Evaluation committee: CAV 2021, ASPLOS 2022.

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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