

# Keshav Bagri

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## EDUCATION

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### The Ohio State University

Columbus, OH

Master of Science in Mechanical Engineering [GPA: 4.0/4.0]

2022 – 2024

Graduate Specialization in Automotive Systems and Mobility

**Thesis:** Quantitative risk assessment and mitigation through fault diagnostics for automated vehicles [[Link](#)]

### Indian Institute of Technology (IIT) Kharagpur

Kharagpur, India

Bachelor of Technology (Hons.) in Mechanical Engineering [CGPA: 9.26/10]

2018 – 2022

Micro Specialization in Embedded Control, Software, Modelling and Design [CGPA: 9.5/10]

**Thesis:** Fault tolerant control system for Electric Vehicles

## PUBLICATIONS AND PEER-REVIEWED CONFERENCES

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- ◇ [Under review] **Bagri, K.**, Rizzoni, G., “Risk quantification and mitigation through fault diagnostics for highly automated vehicles”, IEEE Access.
- ◇ **Bagri, Keshav.** “Quantitative risk assessment and mitigation through fault diagnostics for automated vehicles.” Master’s thesis, Ohio State University, 2024. [[Link](#)]
- ◇ Singh, Y., **Bagri, K.**, Jayakumar, A., Rizzoni, G. Fault Diagnostics for Oscillatory Failure Case in Aircraft Elevator Servos. IFAC World Congress in Yokohama, Japan, July 2023. [[Link](#)]
- ◇ Peer reviewer (upon invitation) for **American Control Conference (ACC)** (2024 & 2025) and **Modeling Estimation and Control Conference (MECC)** (2024).

## AWARDS AND ACHIEVEMENTS

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- ◇ Member, American Society of Mechanical Engineers (ASME) Technical Committee on Automotive and Transportation Systems
- ◇ Member, International Federation of Automatic Control (IFAC) Technical Committees on Automotive Control and Transportation Systems
- ◇ **2<sup>nd</sup> place** in “Aerospace Competition on Fault Detection & Fault Tolerance” at **IFAC World Congress 2023** by **Airbus**
- ◇ **Gold Medal** in Inter IIT Tech Meet 10.0 (2022) in the event “Powered Bonnet for EVs” by **Jaguar Land Rover India**
- ◇ **1st place** in Combustion category & Engineering Design among **31 teams** globally at Formula Bharat Virtuals 2021-22
- ◇ **Gold Medal** in Inter IIT Tech Meet 9.0 (2021) in the event “Bosch’s Electric Vehicle Simulation” by **Robert Bosch India**

## PROFESSIONAL EXPERIENCE

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### Lucid USA, Inc.

Newark, CA

Engineer, Battery Algorithms

August 2024 – Present

- ◇ Developing and refining algorithms for controlling the battery’s performance with a focus on optimizing powertrain demands, enhancing user experience, and maximizing battery longevity
- ◇ Planning and executing comprehensive testing to verify software performance under extreme conditions, including temperature variations and unusual driving scenarios
- ◇ Collaborating with data analysts to analyze fleet and customer data, translating insights to improve estimation and control algorithms for charging

### The MathWorks Inc.

Natick, MA

Software Developer, Engineering Development Group | [[Simulink Fault Analyzer](#)]

May 2023 – August 2023

- ◇ Engineered the **full stack development** of a feature to analyze fault trees, reducing safety engineers’ workload by **50%**
- ◇ Incorporated functionalities to enable the precise determination of **failure probability** & identification of **minimal cut sets**
- ◇ Recognized limitations in the existing implementation, proposing actionable solutions to improve the efficiency by **30%**

### Center for Automotive Research, The Ohio State University

Columbus, OH

General Motors - SAE AutoDrive Challenge II | [[Center for Automotive Research](#)]

Graduate Research Associate | Advisor: [Prof. Giorgio Rizzoni](#)

August 2023 – August 2024

- ◇ Developed an optimal graph-based dynamic rerouting algorithm, enabling real-time on-demand computation of a new trajectory for obstacle avoidance in an urban driving environment, ensuring efficient navigation towards the global goal
- ◇ Devised a Finite State Machine - based behavior planner for navigation in an urban environment using object and traffic sign detections for decision-making and collision avoidance
- ◇ Coordinated with the systems safety, perception, & CAN teams to develop testing scenarios, considering key requirements

Co-Lead, Planning & Controls team

August 2022 – May 2023

- ◇ Devised a polynomial-interpolation-based **trajectory generation** module to sample waypoints for lane change maneuver

- ◊ Formulated the logic for **lane changing maneuver** in a highway environment & performed SIL testing for edge cases
- ◊ Assisted in formulating the **Functional Interface Analysis** & Requirements Traceability Matrix, ensuring safety compliance

## WMG, University of Warwick

Research Collaborator | [[Intelligent Vehicles](#)]

Coventry, UK

January 2022 – July 2022

- ◊ **Project:** Robust translation between 2 levels of Scenario Description Language
- ◊ Developed the Java-based translation framework between levels of **Scenario Description Language** for ADS simulation
- ◊ Formulated the mapping between environmental features and language variables using the taxonomy defined in **PAS 1883**
- ◊ Defined the boundary conditions for the agents' maneuver to describe the **Synchronised Serial Maneuver Sequences**

## Revolute Robotics

Controls Engineer | [[Revolute Robotics](#)]

Tucson, AZ

March 2022 – July 2022

- ◊ **Project:** Develop optimal motion control algorithms for a Hybrid Mobility Robot
- ◊ Modified the **min. jerk trajectory** planner for smooth navigation using a dynamic window of **3 waypoints** per time step
- ◊ Formulated the cost-based **path planning & obstacle avoidance** approach using min. jerk planner & A\* search algorithm
- ◊ Identified multiple methods to enable **data-logging** over cloud from the flight controller thus reducing manual intervention

## Center for Automotive Research, The Ohio State University

Research Intern | Advisor: [Dr. Jeffrey P. Chrstos](#)

Columbus, OH

February 2021 – March 2022

- ◊ **Project:** Performance assessment of Driver-in-Loop simulators
- ◊ Reviewed literature for absolute and relative validity of medium fidelity D-i-L simulators for **physical validation**
- ◊ Proposed the **testing methodology** for the simulator's platform's motion and analyzed the results in the essence of OMCT
- ◊ Utilized the output of **LVDTs** for multiple displacement inputs to compute the platform's roll & pitch angles using MATLAB

## Ati Motors

Winter Intern | *Autonomy team*

Bengaluru, India

November 2020 – January 2021

- ◊ **Project:** SLAM for autonomous cargo delivery vehicles
- ◊ Explored multiple **SLAM algorithms** like IMLS, EKF, Gmapping, etc. to select an efficient method for implementation
- ◊ Implemented the **Particle Filter** SLAM algorithm to build maps on a 2D grid using lidar and wheel odometry in Python
- ◊ Analysed the effects of multiple **resampling algorithms** and variation in **hyperparameters** on the map's quality

## Autonomous Robots and Multi-robot Systems Lab, IIT Bombay

Research Intern | Advisors: [Prof. Leena Vachhani](#) and [Prof. Arpita Sinha](#) | [Website](#)

Mumbai, India

July 2020 – October 2020

- ◊ **Project:** Motion planning for autonomous vehicles in a non-signalized environment
- ◊ Formulated the **Markov Decision Process** representation for the agent considering different state and action spaces
- ◊ Generated training datasets for a **RL model** for the safe traversal of the vehicle in a **non-signalized** environment
- ◊ Developed a **Finite State Machine** for lane following & 2-way lane intersection (without traffic signals) management

## PROJECTS

### Formula SAE powertrain development | TeamKART | [[Website](#)]

Supervisor: [Prof. Dhananjay Kumar Srivastava](#)

IIT Kharagpur

June 2019 – August 2021

- ◊ Designed the **fuel tank** and the mounting arrangement for the vehicle considering the optimal capacity requirement
- ◊ Designed and analyzed the components of the **transmission** and **cooling system** for a standard FSAE electric vehicle
- ◊ Engineered the **intake manifold & crossflow radiator** for a single cylinder engine, producing a power output of **35 HP**
- ◊ Performed **engine simulations** in Ricardo WAVE and **CFD analysis** using Ansys Fluent for designing the intake manifold

### Fault tolerant control system for electric vehicles

Supervisor: [Prof. Somnath Sengupta](#) | *Advanced Technology Development Center*

IIT Kharagpur

February 2021 – April 2022

- ◊ Worked on the modeling of integrated **ABS & regenerative braking** for efficient braking & maximum energy recuperation
- ◊ Engineered a **non-linear state estimator** using vehicle dynamics' equations to generate estimates of the vehicle's conditions
- ◊ Designed a novel **constraint-aware PI - sliding mode controller** for regulating the stability under all driving conditions
- ◊ Explored the possibility of integrating the novel controller with **reconfigurable control allocator** for fault-tolerant control

### Mathematical modelling of Li-ion batteries focusing on Si anode particles

Supervisor: [Prof. Jeevanjyoti Chakraborty](#) | *Mechanical Engineering Department*

IIT Kharagpur

February 2020 – January 2021

- ◊ Studied the mechanics behind **crack development** and formation of amorphous lithiated Si with time around the Si anode
- ◊ Solved Ordinary and Partial differential equations, using **Finite Difference & Liebmann's methods**, in Python
- ◊ Established a **two-way coupling** relation between diffusion & stress, to understand the effect of one parameter on the other

### Deep reinforcement learning for autonomous vehicles

[[Description](#)] | [Github](#)

IIT Kharagpur

August 2020 – September 2020

- ◊ Deployed a **Dueling DNN** to predict discrete action values & mapped them to continuous signals for vehicle control
- ◊ Used **84x84 RGB** images for the environment perception as the state information collected from the camera sensor
- ◊ Accommodated the wheel odometry, collision & lane invasion sensor data to compute **real-time reward** for the agent

## COURSEWORK / TECHNICAL SKILLS

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**Programming:** C/C++, Git, Python, MATLAB, LaTeX, Arduino, ROS, Atmel Studio

**Softwares:** MATLAB/Simulink, CARLA Simulator, Gazebo, COMSOL

**Coursework:** Powertrain control, Autonomy in Vehicles, Fault diagnosis, Vehicle dynamics & control, Linear Systems Theory

## TEACHING & VOLUNTEERING EXPERIENCE

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### College of Engineering

*GUIDE Peer Mentor*

**The Ohio State University**

*August 2023 – April 2024*

- ◇ Responsible for assisting fresh graduate students in navigating the university by guiding them about university resources

### Department of Mechanical & Aerospace Engineering

*Graduate Teaching Associate*

**The Ohio State University**

*January 2023 – May 2023*

- ◇ Courses: ME 3751 (Kinematics & Mechanism Design) and ME 3670 (Design & Analysis of Machine Elements)
- ◇ Responsible for conducting weekly recitations, office hours and doubt clarification sessions for a batch of 60+ UG students

## LEADERSHIP EXPERIENCE

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### Captain

*General Motors – SAE AutoDrive Challenge II*

**The Ohio State University**

*May 2023 – August 2024*

- ◇ Leading a team of 20+ students from Ohio State to prototype the hardware & software stack for SAE Level 4 autonomy
- ◇ Responsible for coordinating with different sub-teams to establish the pipeline, in accordance with project requirements

### Deputy Team Leader

*TeamKART, Formula SAE*

**IIT Kharagpur**

*July 2020 – August 2021*

- ◇ Leading a dedicated team of **47** students towards the research & development of Formula Student prototype vehicle
- ◇ Prepared the design & manufacturing timeline and procurement plan to ensure a smooth & efficient workflow for project **K6**

## PROFESSIONAL REFERENCES

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- ◇ Prof. Giorgio Rizzoni (Email: [rizzoni.1@osu.edu](mailto:rizzoni.1@osu.edu))
  - Professor, Departments of MAE and ECE at The Ohio State University
  - Director at the Center for Automotive Research (OSU)
  - Ford Motor Company Chair in Electromechanical Systems
- ◇ Prof. Qadeer Ahmed (Email: [ahmed.358@osu.edu](mailto:ahmed.358@osu.edu))
  - Assistant Professor, Department of MAE at the Ohio State University
  - Core affiliate faculty of the Center for Automotive Research (OSU)
- ◇ Prof. Lisa Fiorentini (Email: [fiorentini.2@osu.edu](mailto:fiorentini.2@osu.edu))
  - Clinical Professor, Department of ECE at the Ohio State University
  - Associate Fellow at the Center for Automotive Research (OSU)
- ◇ Prof. Andrea Serrani (Email: [serrani.1@osu.edu](mailto:serrani.1@osu.edu))
  - Professor, Department of ECE at the Ohio State University
- ◇ Prof. Somnath Sengupta (Email: [sengupta.s@atdc.iitkgp.ac.in](mailto:sengupta.s@atdc.iitkgp.ac.in))
  - Assistant Professor, Advanced Technology Development Center (ATDC) at IIT Kharagpur
- ◇ Ying Shi ([LinkedIn](#))
  - Sr. Manager, Battery Algorithms, Lucid Motors
- ◇ Giovanni Miraglia ([LinkedIn](#))
  - Sr. Software Engineer, The MathWorks Inc.
- ◇ Mahesh Nanjundappa ([LinkedIn](#))
  - Software Engineering Manager, The MathWorks Inc.