# William Ebenezaraj

IIT Kharagpur, India

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## Education

**Indian Institute of Technology Kharagpur** **June 2019 – Present**

*Bachelor of Technology (Aero Engg, min. Mech Engg, sp. Embedded Controls), CGPA:* 8.82/10 *Kharagpur, West Bengal, IN*

## Areas of Interest

Nonlinear Flight Dynamics, Flight Control Systems, Embedded Systems, Aerospace Robotics, Active Flow Control

## Experience

**Advanced Drones Research Group | IIT Kharagpur | Prof. Bandopadhyay** **Dec '20 – Present**

*Founder, and Head PFD (Performance and Flight Dynamics)* *IIT Kharagpur, West Bengal, IN*

- Pioneered first-ever defence-oriented drone group in campus with entrepreneurial goals under Prof. A. Bandopadhyay.
- Managing 30 talented students from over 5 departments to work on various sub-modules, ensuring proper coordination.
- Oversaw the initial sizing and aerodynamic design and full-body CFD. Actively contributed to the Controls team.
- Conducted several lecture sessions for students unfamiliar with flight performance and dynamics on a weekly basis.

## Projects

**STM32 High-Speed Strain DAQ System | Prof. Anup Ghosh** | *EasyEDA, STM32CubeIDE* **Aug '21 - Ongoing**

- Developed a high-speed 24-bit DAQ system on the Nucleo STM32H743ZI sampling strain measurements at 4 MHz.
- Data buffered locally in on-chip SRAM before dispatch to computer via TCP/IP on the Ethernet (RJ45) port.
- Conducted FFT (Fast Fourier Transform) to obtain frequency of cantilever beam oscillation for validation.
- Currently working on multi-channel strain acquisition, development of a standalone unit, and simple user interface.

**Nonlinear Model Predictive Controller | Prof. Debashish Chakravarty** | *ROS, CARLA* **Jul '21 - Aug '21**

- Developed an MPC with local path planning for real-time collision avoidance in a dynamic traffic environment.
- Demonstrated faster optimization using **iLQR** over the popularly used **IPOPT**, formulated using **CaSADi**.
- Despite running a nonlinear dynamic bicycle model, Achieved exceptional online optimization and real-time execution.

**Vision-Based Line-Following Minidrone on Simulink | EMEA 2021** | *MATLAB, Simulink* **Jul '21 - Aug '21**

- Developed an image processing based algorithm for line following. Drone successfully navigated turns up to $\pm 170°$.
- **Hough transform** used to detect circular landing spot, soft landing conducted at designated spot.
- Highly efficient C code generated and real-time capable performance achieved with seamless module integration.

**Conceptual Design of an eVTOL aircraft | Prof. N. Peyada** | *Solidworks, MATLAB* **Sep '20 - Jun '21**

- Performed power analysis using **MATLAB** and **JavaProp**, requirements: 250 km/h cruise speed and 500 km range.
- Estimated power requirements for hover, cruise, and transition flight phases and determined battery capacity required.
- Researched trends in battery and motor technologies for around 2030. Also was responsible for the aircraft CAD model.

**Design and Analysis of Mars Rover | University Rover Challenge** | *Solidworks, Ansys Static* **May '20 - Aug '21**

- Used **Solidworks**, Solidworks Motion, and **Ansys Static Structural** to design a mars rover for participation at URC.
- Designed an innovative non-pneumatic wheel using TPU-92A for shock absorption and long durability.
- Conducted static simulations to test all structures using high factor of safety loads to check joint and structure integrity.

## Relevant Coursework

- Flight Vehicle Controls
- Transform Calculus
- Numerical Solutions of DE
- Embedded Controls and Software
- Mechanics of Flight
- High Speed Aerodynamics
- Thermodynamics
- Fluid Mechanics
- Machine Learning

## Internships

**IIT Bombay | Prof. Rajkumar Pant** **May '21 – Jul '21**

*Flight Mechanics and Stability Technical Content Creator*

- Conceptualized and created content to get the students of *Introduction to Flight* on NPTEL deeply interested.
- Conducted a detailed study on the climb and cruise performance of an Airbus A320 aircraft on **MATLAB**.
- Used **Gnuplot** and **OpenCV** to develop an animated graphic showing various state variables during climb and cruise.
- Created lecture notes on Flight Mechanics and Performance in **LaTeX** and high-quality slides for in-class sessions.

## Technical Skills

**Design, Modeling, & Analysis**: MATLAB, Simulink, Solidworks, Ansys Fluent, EasyEDA, LtSpice
**Languages & Scripting**: C, C++, Python, MATLAB, AVRASM, AVR-C, FORTRAN, LaTeX, markdown, bash
**Manufacturing**: Multilayer PCB Design and Fabrication, Soldering, Additive Manufacturing, Machining
**Misc**: Word Processing, Spreadsheet, Linux, Windows, vim, gnuplot, Inkscape, git, ROS, XCTU, Atmel Studio 7, HTML5