Karthik Mahesh

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Education

Indian Institute of Technology Bombay *Mumbai, India*

Bachelor of Technology (with Honours) in Aerospace Engineering *Jul 2015 - PRESENT*

- Current cumulative GPA of 9.16 on a scale of 10 (Class rank 4)
- Pursuing a minor in Systems and Control Engineering
- Switched major from Computer Science to Aerospace Engineering after first year

Research Interests

Aircraft Design Conceptual design, Configuration and Shape Optimization, Design for Air Transportation

Aerodynamics Supersonic Aerodynamics, CFD, Methods to predict nonlinear aerodynamic behaviour

Scholastic Achievements

AP Grades, Awarded for outstanding performance in **Flight Mechanics** and **Aircraft Design** *2017-18*

JEE Advanced, All India Rank **22 out of 1.3 million** people *2015*

Indian National Physics Olympiad, Awarded Gold Medal for listing among 35 qualifying for the International Physics Olympiad Selection camp out of 30000 people *2015*

Academic Projects

Optimization of Supersonic Aircraft Geometries *Guide: Prof Avijit Chatterjee*

Bachelor's Thesis *Jul 2018 - PRESENT*

Developing an automated design framework to integrate low and high fidelity analysis methods to conduct noise optimization in conceptual design itself, expected to yield improved results over optimizing a completed configuration

- Obtaining a target equivalent area distribution for a geometry from basic parameters like weight, cruise speed and altitude using Seebass-George-Darden sonic boom minimization theory and propagation through a real atmosphere
- Parametrizing the geometry using the OpenVSP tool and integrating the SU^2 CFD suite through the SUAVE environment to find the equivalent area distribution
- Using a genetic algorithm to vary parameters based on the nearness of the actual area distribution to the target

Design of Multi-Mission Amphibian Aircraft *Guide: Prof G.R. Shevare*

Team Leader (National Aerospace Conceptual Design Competition) *Oct 2017 - May 2018*

- Designed an amphibian short-takeoff-and-landing aircraft capable of operating Commuter and Air-Sea-Rescue missions conforming to the Federal Aviation Administration's FAR Part 23 requirements
- Compiled a database of over 50 amphibian aircraft and identified trends and key performance requirements
- Conducted a Speed-to-Weight trade study yielding 20% speed increase to 270 kmh to compete with existing aircraft
- Achieved predicted design water takeoff length 35% shorter than the average of seaplanes in this weight class

Summer Undergraduate Research Program *Guide: Prof Rajkumar S. Pant*

Course Material Preparation *May 2017 - Jul 2017*

- Prepared lecture slides and quizzes on Lift Generation and Airfoils for a graduate level Introduction to Flight course
- Successfully proposed the inclusion of the concept of streamline curvature to more intuitively and thoroughly explain lift generation, and reconcile the circulation and Newton's theory based approaches
- Coordinated with a team of eight people to improve course content, decide on assignments and evaluation scheme

Performance Analysis of Scramjets *Guide: Prof Krishnendu Sinha*

Winter Project *Dec 2016*

- Compiled a comprehensive global database of Scramjet programs to compare features and technologies developed
- Studied fuel cooling and aerodynamics technologies used in the Boeing X-51 and NASA X-43 programs
- Implemented a Scramjet analysis procedure in MATLAB based on 2D analysis and validated off-design flight conditions

Course Projects

Design of Tube-Stowable UAV *Guide: Prof Rajkumar Pant*

Aircraft Design Lab *Jul 2018 - Oct 2018*

Performed a conceptual design exercise of a tube-stowable UAV according to the problem statement of the 2017 AIAA Design-Build-Fly competition.

- Formulated a new method for wing weight estimation in UAVs based on balsa wood construction
- Achieved a predicted Maximum Gross Weight within 15% of the winning competitor

Backstepping control of UAV longitudinal dynamics *Guide: Prof Srikant Sukumar*

Adaptive Control Theory *Mar 2018 - Apr 2018*

Numerically simulated an existing adaptive backstepping based control strategy in MATLAB for the forward velocity and flight path angle of a UAV with unknown aerodynamic parameters, including the effects of thrust saturation

Ariane 5 Launch Simulation *Guide: Prof Ashok Joshi*

Spaceflight Mechanics Course Project *Mar 2017 - Apr 2017*

Wrote a program to reproduce the launch and orbit parameters derived from various sources of the launch of the Envisat satellite to Low Earth Orbit aboard the Ariane 5 rocket

- Corrected the launch vehicle dynamics equations to account for spherical earth, Coriolis force, thrust angle of attack and the constant burn rate of solid rocket boosters
- Used a 4th order Runge Kutta method to numerically solve the equations for each stage and obtained results matching with online data to within 1%

Professional Experience

Boeing Test and Evaluation *Bengaluru, India*

Engineering Intern *May 2018 - Jul 2018*

- Developed an Excel tool interfacing with CATIA to accelerate design of structural testing whiffletrees through automation
- Implemented a new method to construct a wire frame by utilizing the physics of the structure as opposed to inspection, and extended the method to build the frame in any orientation through extensive use of coordinate geometry
- Interfaced with CATIA through VBA to automatically draw the 3D wire frame model after optimizing part lengths
- Improved existing CATIA models to generate parts at the required location and orientation, saving time during assembly
- Potential savings of 1250 man-hours a year by reducing evaluation time of two designs from 10 days to 10 minutes

Positions of Responsibility

Institute Aeromodelling Secretary

Institute Technical Council *Apr 2017 - Mar 2018*

- Led a team in fostering interest in Aeromodelling by organizing workshops, talks and airshows, and facilitating projects
- Coordinated the Institute Technical Summer Projects 2017, a platform for developing self-ideated projects from freshmen where 150+ freshmen completed their projects
- Organized the annual RC Plane Competition, which acts as an introduction to aeromodelling, with over 400 participants
- Conducted workshops on RC Aircraft design, quadcopters and gliders with turnouts of over 200 people
- Organized first airshows under the Institute Tech Council, with professional flyers and aerobatics with 2m-long planes

Teaching Assistant

Department of Physics *Jul 2016-PRESENT*

- Taught in tutorial hours for two courses, Quantum Physics(PH107) thrice and Electromagnetism(PH108) twice
- Responsible for problem-solving, explaining concepts and clearing doubts, and evaluating exams

Student Mentor
Department Academic Mentorship Program *Apr 2017 - PRESENT*

- Selected on the basis of academics and peer review to guide academically weak and sophomore students
- Trained by Tata Institute of Social Sciences to better understand and respond to student problems

Technical Skills

Experienced C++, Python (scipy, numpy), MATLAB, CATIA, VBA,OpenVSP, SU^2, SUAVE, LaTeX
Familiar SolidWorks, ANSYS-Fluent, AutoCAD, Arduino,

Relevant Courses

Aerodynamics CFD, Aerodynamics, Aircraft Design, Numerical Methods for Conservation Laws, Aircraft Design Lab
Controls Flight Mechanics, Control Theory, Adaptive Control, Linear & Nonlinear Systems, Navigation & Guidance
Lab Courses Aerodynamics, Propulsion, Controls, Aircraft Design, Aircraft Structures, Aerospace Measurements
Aerospace Aircraft Propulsion, Rocket Propulsion, Aerospace Structures, Structural Dynamics, Spaceflight Mechanics

Extracurricular Activities

Drums Competed in Goonj inter-hostel music league in 2017 and 2018, stood fourth in 2017
Sports played Tennis, Karate(Black belt)