

# Praneet Vayalali

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## Summary

A highly motivated engineer with a passion for aviation pursuing work in the field of flight dynamics and control on VTOL aircraft. Current work focuses on development of VoloCity Flight Simulator in order to ensure its functional scope for type certification of the VoloCity aircraft.

## Education

### Ph.D. in Aeronautical Engineering

RENSSELAER POLYTECHNIC INSTITUTE (RPI), GPA - 3.83/4

Aug. 2016 - Dec. 2021

Troy, NY, USA

### Master of Technology in Aerospace Engineering

INDIAN INSTITUTE OF TECHNOLOGY KANPUR (IIT K), GPA - 9.25/10

July 2014 - July 2016

Kanpur, India

### Bachelor of Technology in Aerospace Engineering

AMRITA SCHOOL OF ENGINEERING (ASE), GPA - 8.91/10

July 2009 - June 2013

Coimbatore, India

## Technical Skills

#### Softwares

FLIGHTLAB, MATLAB/Simulink, CONDUIT, CIPHER, LabView, Ansys Fluent, Abaqus, Xfoil

#### Languages

C++, Python

#### General

Git, Siemens Teamcenter, Xplane, Linux, Microsoft Office Suite, Latex

## Work & Research Experience

### Flight Simulation Engineer

FLIGHT SCIENCE DEPARTMENT, VOLOCOPTER GMBH

Dec. 2021 - Current

Bruchsal, Germany

- Development of the engineering flight simulator software and hardware environment.
- Verification and Validation of flight physics simulation model using test bench and flight test data
- Development of processes in accordance with EASA MOC-8 for the flight simulator
- Planning and coordination of flight simulator development to support aircraft design development and certification process
- Provide test support for handling qualities, flight controls, aircraft flight manual, safety, and human factors
- Prepare and review certification documents (certification plans, analysis reports, test proposals/results)
- Additionally, performed handling qualities assessment, aeroelastic stability analysis (flutter, whirl-flutter, divergence), and aeroservoelastic stability analysis (open and closed-loop)

### Post-Damage Reconfiguration for Rotorcraft with Control Redundancy

PH.D. DISSERTATION, ADVISOR - DR. FARHAN GANDHI

Aug. 2016 - Oct. 2021

RPI, NY, USA

- Examine adaptive and robust fly-by-wire flight control strategies that can tolerate damage/degradation in various control effectors to enable safe flight on VTOL aircraft with control redundancy.
- Perform nonlinear flight simulation and handling qualities (ADS-33E) based analysis on the use of various control allocation and modern control design techniques on a UH-60 Black Hawk and derivative compound helicopter platforms.

### Post-Failure Control Reconfiguration on a High-Speed Lift-Offset Coaxial Helicopter

RESEARCH PROJECT, ADVISOR - DR. FARHAN GANDHI

Aug. 2019 - Oct. 2021

RPI, NY, USA

- Work with a team of two to investigate the potential for fault compensation in flight for a lift-offset coaxial helicopter by examining the interchangeability of controls at different points within the flight envelope, thereby identifying allowable fault cases for the vehicle.
- Helped with the development of an elastic blade coaxial-pusher helicopter trim model based on the X2 Technology™ demonstrator which was then used to explore trim control variation in different flight regimes.

### Frequency Domain Based System Identification of a Small-Sized RUAV

MASTER'S THESIS, ADVISOR - DR. A. ABHISHEK

May 2015 - Jul. 2016

IIT Kanpur, India

- Characterized a fully instrumented small-size rotary-wing unmanned aerial vehicle (RUAV) using a frequency domain based experimental system identification technique.
- Flight test of a 1 kg class RUAV was conducted and its responses were recorded. The closed-loop responses were analyzed to extract a bare-airframe 6-DOF linear flight dynamics state space model of the aircraft for hover flight condition. This was followed up by flight test validation.

### Characterization and Modeling of Uncertainties in Composites

RESEARCH PROJECT, ADVISORS - DR. C.S. UPADHYAY & DR. P.M. MOHITE

Aug. 2013 - Jul. 2014

IIT Kanpur, India

- Conducted over 500 axial recoil tests on single carbon fibers of varying lengths and diameters (order of 10 microns) in order to determine the compressive strength of the fiber. This experimental data was then used to statistically model the uncertainty in strength due to various parameters.

## Detection of Cracks in a Wind Turbine Blade using Modal Analysis

Jan. 2012 - Jun. 2013

BACHELOR'S THESIS, ADVISORS - DR. LAXMAN VAITLA & DR. V.L. SATHEESH (NATIONAL AEROSPACE LABORATORIES)

ASE, India

- Examined frequency response of non-rotating GFRP (Glass Fiber Reinforced Plastic) rectangular beams using finite element analysis for varying delamination sizes and positions.
- Conducted sinusoidal sweep experimental tests on GFRP beams to validate the simulation results.
- Performed modal analysis (using finite element method) on rotating composite beams to simulate rotating wind turbine blades.

## Projects

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### Backstepping Control for a Variable-RPM Quadrotor Aircraft

Jan. 2019 - May 2019

NONLINEAR CONTROL SYSTEMS COURSE PROJECT

RPI, NY, USA

- Demonstrated the applicability of backstepping control design to a hobbyist scale quadrotor vehicle.
- Examined the performance of a backstepping feedback controller in comparison to a PID controller on the quadrotor.

### Extreme Altitude Mountain Rescue Vehicle

Jan. 2019 - May 2019

THE VERTICAL FLIGHT SOCIETY'S 36TH ANNUAL STUDENT DESIGN COMPETITION

RPI, NY, USA

- Proposed a synchropter as a VTOL aircraft design capable of search and rescue missions at the summit of Mt Everest, where only one helicopter has ever landed and taken off again.
- Developed a flight dynamics model and analyzed the autonomous dynamics of the proposed rotorcraft design. Design constraints include freezing temperatures, thin air and hostile weather conditions with degraded visual environment all contribute to making rescue work in high-altitude environments particularly dangerous or impossible.
- Won third place in the graduate category the vertical flight society's 36th annual student design competition.

### Power Optimization for UH-60 Black Hawk in Cruise using Variable RPM and Stabilator

Sept. 2017 - Dec. 2017

INDEPENDENT STUDY FOR ADVANCED DESIGN OPTIMIZATION COURSE

RPI, NY, USA

- Optimized power using the main rotor speed and stabilator pitch incidence as design variables on a physics-based UH-60 Black Hawk helicopter simulation model at a cruise speed of 140 knots.

### Controller Design for a Quadrotor UAV

Jan. 2017 - May 2017

HELICOPTER DESIGN COURSE PROJECT

RPI, NY, USA

- Nonlinear flight simulation model with PID and LQR controllers were developed for a 2 kg quadrotor helicopter and their performance was compared in simulation.
- Compared control schemes using controller gains tuned for the hover flight condition and flown for single waypoint and multiple waypoint trajectories.

### Design of V/STOL Air Taxi

Dec. 2014 - May 2015

AIAA FOUNDATION GRADUATE TEAM AIRCRAFT DESIGN COMPETITION

IIT Kanpur, India

- Worked with a team of seven to propose a design for an air taxi system that operates out of confined urban areas requiring vertical and short takeoff and landing capability.
- Involved in the design of a ducted rotor system for the V/STOL aircraft with consideration of noise and safety.

## Journal Articles

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- McKay, M., **Vayalali, P.**, Gandhi, F., Berger, T., Lopez, M.J.S., "Control Allocation Reconfiguration for Actuator Failure on a Coaxial-Pusher Helicopter", Journal of the American Helicopter Society, Vol. 68(3), July 2023, pp. 32004-32015(12), DOI:10.4050/JAHS.68.032004.
- **Vayalali, P.**, McKay, M., Krishnamurthi, J., Gandhi, F., "Fault-Tolerant Control on a UH-60 Black Hawk Helicopter using Horizontal Stabilator," CEAS Aeronautical Journal, Vol. 12(1), Jan. 2021, pp. 13-27, DOI:10.1007/s13272-020-00476-5.
- **Vayalali, P.**, McKay, M., Krishnamurthi, J., Gandhi, F., "Horizontal Stabilator Utilization for Post Swashplate Failure Operation on a UH-60 Black Hawk Helicopter," Journal of the American Helicopter Society, Vol. 65, Apr. 2020, pp. 1-13(13), DOI:10.4050/JAHS.65.022009.

## Conference Proceedings

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- **Vayalali, P.**, McKay, M., Gandhi, F., "Fault-Tolerant Control Allocation on a Compound Helicopter in Cruise," Proceedings of the Vertical Flight Society 77th Annual Forum, Virtual, 10-14 May 2021.
- McKay, M., **Vayalali, P.**, Gandhi, F., Berger, T., Lopez, M. J. S., "Redistributed Allocation for Flight Control Failure on a Coaxial Helicopter," Proceedings of the Vertical Flight Society 77th Annual Forum, Virtual, 10-14 May 2021.
- **Vayalali, P.**, McKay, M., Gandhi, F., "Redistributed Pseudoinverse Control Allocation for Actuator Failure on a Compound Helicopter," Proceedings of the Vertical Flight Society 76th Annual Forum, Virtual, 6-8 Oct 2020.
- McKay, M., **Vayalali, P.**, Gandhi, F., "Post-Failure Control Reconfiguration for a Lift-Offset Coaxial Helicopter," Proceedings of the Vertical Flight Society 76th Annual Forum, Virtual, 6-8 Oct 2020.
- **Vayalali, P.**, McKay, M., Krishnamurthi, J., Gandhi, F., "Robust Use of Horizontal Stabilator in Feedback Control on a UH-60 Black Hawk," Proceedings of the Vertical Flight Society 75th Annual Forum, Philadelphia, PA, 13-17 May 2019.
- **Vayalali, P.**, McKay, M., Krishnamurthi, J., Gandhi, F., "Swashplate Actuator Failure Compensation for UH-60 Black Hawk in Cruise Using Horizontal Stabilator," Proceedings of the 74th American Helicopter Society Annual Forum, Phoenix, AZ, 7-10 May 2018.

## Honors & Awards

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2018	<b>Third Place</b> , The Vertical Flight Society's 36th Annual Student Design Competition	Virginia, USA
2017	<b>Runner-up</b> , The American Helicopter Society Northeast Region Robert L. Lichten Award Competition	Stratford, USA
2012	<b>Second Place</b> , RC aircraft modeling event as a part of techfest of Amrita School of Engineering	Coimbatore, India
2010	<b>First Place</b> , SAE College level Aero Modeling Tier I event	Coimbatore, India

## Professional Societies

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### Vertical Flight Society (VFS)

2016 - 2022

#### MEMBER

Fairfax, VA, USA

- President, RPI student chapter (2020-2021)
- Senior Student Volunteer (SSV), one of the 8 SSVs responsible for all A/V at VFS Forum 76 Virtual (2020)
- Student Volunteer at Forum 73 (2017), Forum 74 (2018) & Forum 75 (2019)

### American Institute of Aeronautics and Astronautics (AIAA)

2014 - 2021

#### STUDENT MEMBER

Reston, VA, USA

- Participated in the AIAA Foundation Graduate team Aircraft Design Competition (2015)

## References

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### Dr. Farhan Gandhi

Rosalind and John J. Redfern Jr., '33 Endowed Chair in Aerospace Engineering, Director, Center for Mobility with Vertical Lift (MOVE), Rensselaer Polytechnic Institute, NY USA  
Email: gandhf@rpi.edu, Phone: 518-276-3244

### Dr. Sandipan Mishra

Associate Professor,  
Mechanical Aerospace and Nuclear Engineering  
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