

Chams Eddine Mballo

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RESEARCH INTERESTS

Flight Mechanics and Control, Control Theory, Urban Air Mobility, Model Predictive Control, Operator Theory, Hilbert Spaces, Machine and Reinforcement Learning

EDUCATION

Georgia Institute of Technology Atlanta, Georgia
PhD in Aerospace Engineering Jan 2017 – Dec 2021
Mentors: Professor J.V.R. Prasad

Georgia Institute of Technology Atlanta, Georgia
MS in Mathematics Jan 2021 – Dec 2021

Georgia Institute of Technology Atlanta, Georgia
MS in Electrical and Computer Engineering Aug 2019 – Dec 2020
Mentor: Professor Eric Feron

Georgia Institute of Technology Atlanta, Georgia
MS in Aerospace Engineering Aug 2016 – Dec 2019
Mentor: Professor J.V.R Prasad

University at Buffalo, SUNY Buffalo, New York
BS in Mechanical Engineering Aug 2011 – May 2015
Mentor: Professor Ehsan Tarkesh

University at Buffalo, SUNY Buffalo, New York
BS in Aerospace Engineering Jan 2011 – May 2015
Mentors: Professors Gary Dargush, John Crassidis

AWARDS AND DISTINCTIONS

1-Marcus Dash Fellowship (Georgia Tech)	2021
1-Rising Stars in AE (MIT)	2021
2-Robert Wolfe Fellowship (Georgia Tech)	2020
3-GRAD RISE Scholarship	2019
4-Featured in Vertiflite Magazine	2018
5-Featured in Vertipedia	2018
6-Vertical Flight Foundation Scholarship	2018
7-SUNY Chancellors Award for Student Excellence	2015
8-Undergraduate Research and Scholarship Award of Distinction	2015

9-University at Buffalo Advanced Honors Scholar with Thesis	2015
10-Honors College Research and Creativity Fellowship	2014
11-Young Lee Scholar	2014, 2015
12-Zimmer Scholar	2014

PUBLICATIONS

“Trade-off between Maneuver Performance and Component Load Limiting”

Mballo, C., Prasad, J.V.R.,

In preparation to the Journal of Guidance, Control, and Dynamics

“Individual Blade Control for Component Load Alleviation using a Model Predictive Control Formulation”

Mballo, C., Prasad, J.V.R.,

In preparation to the Journal of the Vertical Flight Society

“Load Alleviation Control vs. Damage Mitigation Control for Component Life Extension”

Mballo, C., Aarohi, S., Prasad, J.V.R., Rimoli, J.,

In preparation to the Journal of the Vertical Flight Society

“Load Limiting Control: A handling Quality Analysis”

Mballo, C., Berger, T., Prasad, J.V.R.,

Proceedings of the 47th European Rotorcraft Forum, 2021.

“Effect of load limiting control on rotorcraft maneuver performance and component damage growth”

Aarohi, S., Mballo, C., Prasad, J.V.R., Rimoli, J.,

Proceedings of the 77th Annual Forum of the Vertical Flight Society, 2021.

“Trade-off between Maneuver Performance and Component Load Limiting”

Mballo, C., Prasad, J.V.R.,

Proceedings of the 76th Annual Forum of the Vertical Flight Society, 2020.

“Helicopter Maneuver Performance with Active Load Limiting”

Mballo, C., Prasad, J.V.R.,

Proceedings of the 45th European Rotorcraft Forum, 2019.

“A Real Time Rotor Component Load Limiting via Model Predictive Control”

Mballo, C., Prasad, J.V.R.,

Proceedings of the 75th Annual Forum of the American Helicopter Society, 2019.

“Load Limiting Control Design for Rotating Blade Root Pitch Link Load Using Higher Harmonic LTI Models”

Mballo, C., Prasad, J.V.R.,

Proceedings of the 44th European Rotorcraft Forum, 2018.

“A Real Time Scheme for Rotating System Component Load Estimation using Fixed System measurements”

Mballo, C., Prasad, J.V.R.,

Proceedings of the 74th Annual Forum of the American Helicopter Society, 2018.

“A LTI/LQE Scheme for Real Time Rotor Component Load Estimation”

Mballo, C., Prasad, J.V.R.,

Proceedings of the 43rd European Rotorcraft Forum, 2017.

**RESEARCH
EXPERIENCE**

Model Based Life Extending Control

Mentor: Prof. J.V.R Prasad (Georgia Tech)

Jan 2017 – Present

- Developed real-time algorithms for estimation of helicopter component level dynamic loads.
- Developed load alleviation and damage mitigation control schemes. for critical component life extension with little impact on vehicles handling quality.
- Carried out pilot simulation evaluations of the developed algorithms and control designs.

Steady-State Closed Form Solution for Kalman Filter Accuracy

Mentor: Prof. John Crassidis (University at Buffalo) Spring 2015 – June 2016

- Independently determined closed form solutions for the error associated with one and two-axis spacecraft attitude estimation in a kalman filter.
- Redefining the matrices of state transition, state noise covariance, measurement of noise covariance and measurement in order to come up with a new and simpler standard kalman filter sequential equation.

Modular Snake Robots

Mentor: Prof. Ehsan Tarkesh (University at Buffalo) Spring 2015 – June 2016

- Developed a modular vehicle to mimic snake motion in their natural habitat that possesses capability to be autonomous and move in various terrains.
- Created snake of several links connected end by end by motorized joints and used a 3D printer to build the custom frames for the snake.
- Performed a dynamic and kinematic simulations using MATLAB (Simulink) to ensure a perfect representation of the lateral undulation motion of a real snake.
- Developed a graphical user interface for the autonomous control of the snake robot.

Orbital Mechanics Analysis

Mentor: Prof. John Crassidis (University at Buffalo) Spring 2015 – June 2016

- Analyzed orbit determination and attitude determination for a satellite orbiting the earth and the Wilkinson Microwave Anisotropy Probe spacecraft respectively.
- Developed an algorithm to determine the position and velocity of the satellite and quaternion trajectory of the spacecraft.
- Designed a control algorithm to find the required torque in order to find the velocity and quaternion trajectories of the spacecraft.

Data acquisition from earthquake simulations

Mentor: Prof. Michel Bruneau (University at Buffalo) Spring 2015 – June 2016

- Monitored various material testing on the advanced 5-degree of freedom 50 ton capacity shake table. The data recorded from those earthquake simulations were then used for statistical analysis.
- Installed the cameras and sensors needed to acquire the data from the earthquake simulations

Computational Aerodynamics: Panel Method

Mentor: Prof. Iman Borazjani (University at Buffalo) Spring 2015 – June 2016

- Analyzed the aerodynamics properties of airfoil sections using panel method for aircraft design purpose.
- Studied the fluid flow over the airfoil 0012 developed by National Advisory Committee for Aeronautics (“NACA”) and calculated the lift coefficient produced by NACA 0012 at different angle of attack using MATLAB.
- Concluded the project by doing a comparative study between the lift coefficient produced by the computational tool (Panel method) and the one given by real experiment data.

GRANTS

Student Government Association Conference Fund June 2018
Travel funds for the Vertical Flight Society Annual Meeting, Phoenix, AZ

College of Engineering Professional Development Fund June 2018
Travel funds for the Vertical Flight Society Annual Meeting, Phoenix, AZ

TEACHING EXPERIENCE

Tutor (Minority Education & Development Center) Fall 2018–Present
-Teach and tutor Math, Physics and Engineering courses at Georgia Tech’s Minority Education and Development Center

Teaching assistant (Georgia Institute of Technology) Fall 2016
AE 3530: System Dynamics and Vibration

Instructor (University at Buffalo) Summer 2016
PHY 107: Introduction to Calculus based Physics

College Prep. Instructor (University at Buffalo) Nov 2015-Jun 2016
-Instruct college level math and physics courses and guide gifted high school students transition to college

Subject Expert (OneClass) July 2015-June 2016
-Teach and tutor Math, Physics and Engineering courses at OneClass

Teaching Assistant (University at Buffalo) Summer 2014
EAS 208: Dynamics

Teaching Assistant (University at Buffalo) Summer 2014
MAE 376: Applied Mathematics for Mechanical and Aerospace Eng.

**MENTORING
EXPERIENCE**

Georgia Institute of Technology
Sharath Yalla (currently undergrad at Georgia Tech) May 2018 – Dec 2018
Zhenhao Jing (currently PhD Student at Georgia Tech) Sept 2017 – Dec 2017
Shane Connelly (currently at GT Research Institute) Mars 2017 – Dec 2017

**SERVICE AND
OUTREACH**

Compassion Relief Fall 2014 – Present

- Helped create a compassion relief based in Buffalo
- Provided tutoring and mentoring services to local students in the Buffalo and New Jersey areas.

Instructor (Özellistikbal İlk öğretim Okulu) Summer 2013

- Conducted a 3 week summer English program to instruct 3rd to 6th grade students to help learn English.
- Examined, through visits and seminars, examples of successful non-governmental organization in Turkey such as Humanitarian Relief Foundation (IHH) and “Kim se yokmu”(“is Anybody there”)
- Learned the crucial steps required to start, run, develop and grow a non-governmental organization.

President of the GT Vertical Flight Society Mars 2019–April 2021

- Organized various events to foster the interest in vertical flight technology among undergrad and grad students.
- Prepared grant proposals in order to fund the events organized by the society

Buffalo Academy of Science Charter School

Fall 2014

- Guided the Buffalo Academy of Science Charter School to build a team to participate in the FTC robotics competition.
- Advised weekly a team of 7 to 12 grade students on efficient techniques in building robust and highly functional robots.
- Raised students interest in STEM fields through weekly mentoring sessions.

Genius Olympiad

Summer 2012

- Supervised high school students from all over the world toward the completion of their projects.
- Helped students prepare posters summarizing their findings. Posters were exhibited in the Science and Art competition at the University of New York at Oswego.

SAT prep Tutor/ Counselor/ Mentor

Fall 2013–Present

- Co-founded an SAT Prep program to help underrepresented and economically disadvantaged students rise out of poverty and elevate their respective communities
- Instructed a classroom of 20 economically underprivileged high school students in an effort to educate and inspire students to seek higher education.
- Conducted a 2 to 3 hours weekly math class session where I went over the different topics that are covered in the SAT

Science is Elementary Program

Fall 2013–Present

- Volunteered to work with a class of about 30 students at Westminster Charter School
- Developed various scientific experiments to explain the underlying science behind covered topics
- Designed hands-on lab work to engage students as well as spark their interest in STEM fields

PROFESSIONAL MEMBERSHIPS

Vertical Flight Society (VFS).

Jan 2017 – Present

National Society of Black Engineers (NSBE).

Jan 2011 – Present

SKILLS

Programming

Proficient in: Python,

Familiar with: C++

Software

Proficient in: Matlab/Simulink, FLIGHTLAB, CIPHER, CONDUIT

Languages

French (fluent), Wolof (fluent), Turkish (advanced)