

# Application Summary

## Competition Details

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<b>Competition Title:</b>	2021 CTL/BP Junior Faculty Teaching Excellence Award
<b>Category:</b>	Institutional Awards - CTL
<b>Award Cycle:</b>	2021
<b>Submission Deadline:</b>	02/28/2021 11:59 PM

## Application Information

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<b>Submitted By:</b>	Ellen Mazumdar
<b>Application ID:</b>	5997
<b>Application Title:</b>	Ellen Yi Chen Mazumdar, Junior Faculty Teaching Award Nomination
<b>Date Submitted:</b>	02/28/2021 11:56 PM

## Personal Details

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<b>Applicant First Name:</b>	Yi
<b>Applicant Last Name:</b>	Mazumdar
<b>Email Address:</b>	ellen.mazumdar@gatech.edu
<b>Phone Number:</b>	

### Primary School or Department

George W. Woodruff School of Mechanical Engineering

<b>Primary Appointment Title:</b>	Assistant Professor
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## Application Details

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### Proposal Title

Ellen Yi Chen Mazumdar, Junior Faculty Teaching Award Nomination

February 18, 2021

CETL/BP Junior Faculty Teaching Excellence Award

Dear Selection Committee,

It is my great pleasure to endorse Prof. Ellen Yi Chen Mazumdar for the CETL/BP Junior Faculty Teaching Excellence Award. I first met Dr. Mazumdar in 2018 while visiting Sandia National Laboratories, where she was conducting her postdoctoral research. I was impressed by the quality of her work and was excited to have her join our faculty in 2019. Today, Prof. Mazumdar is a highly valued member of the Woodruff School of Mechanical Engineering at Georgia Tech, contributing to our research and educational missions. Since joining the Woodruff School, Dr. Mazumdar has consistently demonstrated outstanding performance as an educator with a strong commitment to innovation in the classroom and accessibility for students. This is demonstrated by her high CIOS scores, which consistently range from 4.88 to 5.0 even through the Covid-19 hybrid-teaching period. This last semester, she was on the Class of 1934 CIOS honor roll for receiving a 94% response rate.

Since joining the Woodruff school, she has revitalized our undergraduate Motion Controls (ME 4012) course, which has both a classroom and a hands-on laboratory component. This class had been neglected for several years and had no laboratory exercises when she started teaching the class. Dr. Mazumdar took on the challenge of rebuilding the class from scratch, creating course notes, new assignments, lab manuals, and experimental hardware. She has created 5 new lab assignments focusing on practical hands-on implementation of control systems, such as magnetic levitation systems and Segway robots. Her class also allows students to explore open-ended topics through team hardware projects. These assignments are designed to help students build practical skills, market themselves to employers, and make connections to controls/robotics research. Students have used presentations, project videos, and concepts from her class in interviews; several students have reported successfully finding jobs due to these projects. This unique integration of teaching and career mentorship demonstrates innovation in her teaching style and devotion to impacting student lives outside the classroom. I will also say that her efforts to change this course will impact our students for years to come in a technical area that is only growing in demand within our program. She has modernized this course for our students and has placed it on a level that has now become attractive for additional partnerships with outside companies. This has been outstanding for a junior faculty member.

During Covid-19 period, Dr. Mazumdar expanded flexibility for assignments, increased availability, and altered course elements, allowing students to learn the same material but at a reduced stress level. She has put particular emphasis on helping students who are struggling, giving them additional opportunities to learn material they missed on the first try. Due to her efforts to help students who have struggled in her class, she consistently receives “Thank A Teacher” notes. One student wrote,

*After my graduation, I recall my time here at GT and I think about all these people who influenced me and helped me grow as an engineer... I truly believe that Motion Systems was a unique experience for me that not only helped me understand the engineering principles that I wasn't familiar with before but also provided me with confidence. I will always cherish our office hours discussions, as well as your plentiful advice.*

Dr. Mazumdar has also engaged in several opportunities to grow as an educator. She has also participated in the Class of 1969 Teaching Fellow Program and has contributed to several Celebrating Teaching Day events. Her project focused on making classroom concepts more concrete through the use of in-class and laboratory examples. She has successfully implemented this initiative using customizable tabletop quadrotor systems, which allow students to test different design concepts, modeling techniques, and control strategies. Her students have enjoyed this addition and are excited to learn control concepts can be practically applied in the real world.

In the past year, she was selected to be a University System of Georgia (USG) Chancellor's Learning Scholar. Her project focuses on improving hybrid and remote teaching strategies for laboratory courses at Georgia Tech. She has assembled a team of instructors from Chemistry, Biology, Physics, Mechanical Engineering, Chemical and Biological Engineering, Material Science, and Earth and Atmospheric Science to discuss ideas and methods for improving teaching and learning with limited interpersonal interaction. Her team has come up with many new ideas for safely operating labs as well as engaging students and they have already implemented these ideas in their respective classes across the institute.

Dr. Mazumdar's dedication to teaching extends directly into her research and outreach activities. Every semester, Dr. Mazumdar mentors ~8 undergraduate students in her lab (19 students total since 2019), many of whom joined her lab after taking her class. Her undergraduate students work on projects ranging from soft robotics to controls to system identification techniques to instrumentation development to optical diagnostics development, which are related to topics covered in her class. Many have received PURA research awards, attended international conferences, and co-authored journal papers. She also mentors under-represented undergraduate researchers through the SURE and SURE Robotics program. Her efforts mentoring African American students have earned her recognition through the Faces of Inclusive Excellence in 2020. Several of her undergraduates have received NSF Fellowships through her mentorship and many are graduate students at Georgia Tech and other institutions. Dr. Mazumdar and her students also collaborate heavily with CEISMIC through K.I.D.S. Club and STEAM Workshop serving K-12 students. She works extensively with Tim Cone through the G. T. Girls program, developing microcontroller programming projects that get middle school girls excited about engineering.

Prof. Mazumdar satisfies all the eligibility criteria for this teaching excellence award. She is a full-time assistant professor, currently untenured, who started at Georgia Tech in 2019. She is currently teaching her 5<sup>th</sup> semester and is in her second academic year on the tenure-track. This is also her first time being nominated for this award. Prof. Mazumdar is an excellent teacher, strong student advocate, valuable resource in promoting diversity, and exceptional research mentor. She has already made a tremendous impact on Georgia Tech students and shows a true passion for teaching. We value her creativity, drive, and tireless service to our department. We are extremely fortunate to have her at Georgia Tech and actively support her teaching and research efforts. I give her my strongest possible endorsement for the CETL/BP Junior Faculty Teaching Excellence Award. Please do not hesitate to contact me at [sgraham@gatech.edu](mailto:sgraham@gatech.edu) or 404-894-3201 with any questions.

Sincerely,



Samuel Graham, Jr.  
Eugene C. Gwaltney, Jr. Professor and School Chair  
Woodruff School of Mechanical Engineering

**Dr. Ellen Yi Chen Mazumdar**  
Reflective Statement on Teaching  
Woodruff School of Mechanical Engineering  
February 28<sup>th</sup>, 2021

**Teaching Philosophy**

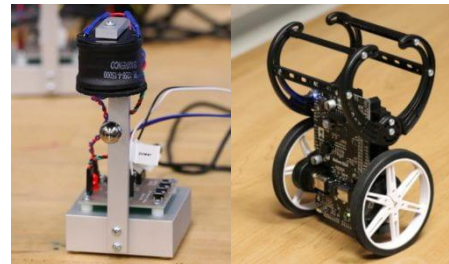
My primary goal as a teacher is to provide students with a welcoming environment for absorbing and synthesizing the material so that they can become our next-generation of engineers. To achieve this goal, I have implemented multiple modes of learning inside and outside of the classroom with lectures on fundamentals, practical examples, hands-on exercises, and open-ended final projects which allow them to demonstrate what they have learned. Rather than forcing memorization of concepts and equations, this strategy creates an intuitive understanding of the material and enables long term retention. Creating excitement with the material is also key for enabling higher-level synthesis. I accomplish this by showing students how concepts from class would be used in the real world for engineering, research, or for fun. Because the material is interesting, students choose to engage with it in their free time, leading them to achieve a deeper understanding of the material. This leads them to ask further questions and to explore graduate level concepts.

Students at Georgia Tech often feel pressure to compete for A's in classes. While this can lead many students to excel, others will give up early or decide that "this field is not for me." With COVID-19 shutdowns and remote learning, this can lead to added stress. In order to mitigate these factors, I have implemented a system that gives students a second chance to correct mistakes and gives students alternative problems for extra credit. I also make it clear that the number of A's in the class is not limited and that everyone can receive one if they show a good understanding of the material, which borrows concepts from specifications grading. By providing transparently on class grades and responding quickly to questions, students who are struggling can be identified early on and provided with additional help and a chance to bounce back. Finally, by putting students into teams during the first week of class to work on homeworks, lab exercises, and projects together, a sense of camaraderie is built around the material. In the past few years, I have combined these elements into my teaching and have successfully demonstrated innovation in the classroom, impact on students, teaching excellence, accessibility to students, connections with research, and extensions of teaching and learning outside the classroom.

**Innovation in the Classroom**

Creating and teaching an undergraduate controls classes has been truly rewarding process. In Spring 2019, I took over the ME 4012 motion controls class, which had been neglected for several years and did not have any lab exercises despite being listed as a laboratory class. Taking on the challenge, I rebuilt the course materials from scratch, creating lecture notes, example problems, homework problems, test problems, and structured laboratory exercises. My main focus was to create a course that I would enjoy taking. As such, I aimed to provide students with an intuitive understanding of controls so that they could determine answers quickly without needing to rely on google or Matlab simulations for answers. Not only would this make students stand out in interviews and meetings, but would also allow them to intuitively correct wrong answers and gain an appreciation for the material.

To accomplish this, I created hand-written notes that summarized concepts from multiple books and created real-world examples of how to use the concepts to solve complex problems. These notes serve as a reference, which replaces the need for a book or student-designed cheat sheets. For homeworks, I created 9 problem sets with problems that put students in the shoes of a hypothetical controls engineer, solving different problems across their company. This scheme allows students to immediately see how class concepts can be used once they graduate. Problems, which are a combination of theory and simulations, build upon



*Figure 1:* Examples of hands-on lab exercises

each other so that students can see how multiple concepts combine to solve bigger questions. Some problems are revisited in later in the semester when new techniques are introduced. Other theoretical derivations connect directly with the laboratory exercises, allowing students to see the connection between different elements of the class.

For the structured hands-on labs, I initially created 5 new exercises that focused on teaching state machine and coding strategies in LabVIEW and Arduino. Then, these skills were expanded upon and students are asked to use feedback control concepts to levitate a magnetic ball and balance an unstable Segway robot, as shown in Fig. 1. Finally, students were taught stochastic system identification techniques, which they used to quickly build Bode plots and implement lead/lag control systems for an electrical circuit. Students have really enjoyed these exercises and often spend extra time working with them to get them just right, as shown in Fig. 2.

To give students the freedom to explore areas that they find interesting, each team is asked to complete an open-ended final project where they have to model, design, construct, and implement a system of their choice. Because each project is unique, I spend significant time with each team solving both theoretical and practical design/electronics issues. With one of the first teams in my class, the students discovered that they could not figure out how to stabilize the system. After a series of discussions with me, we realized that their system was high order and needed two nested control loops in order to balance. The students took my advice quickly and were able to adjust their design and achieve stable control in less than a week. Since concepts for nested control loops are not taught in class, my individual guidance was key to helping them solve this problem. A separate team was attempting to control a double-inverted pendulum system and had struggled for weeks with theory. After speaking with me, however, they discovered that they could not control their system with their original design and instead needed pole placement techniques, which is a graduate level concept. With my help, they implemented this controller and successfully demonstrated balancing for their system. In the last few semesters, access to campus as been reduced due to COVID-19 shutdowns. Despite the fact that I made hardware implementation extra credit, most of the students have chosen to implement their hardware projects from home, which shows how excited they are about this element of the class. Due to the open-ended nature of the project, the students have come up with several unique projects from balancing inverted pendulums to creating suspension systems for cars to balancing a rotationally unstable boat. Many of these projects are shown in Fig. 3 and videos for every student team project from each semester (students signed a group release waiver) can be found on the class webpage (<https://sites.gatech.edu/me4012/>) or on the class Youtube channel ([https://www.youtube.com/channel/UCmQjPNEjSZ\\_pXTsKlcKlfhw](https://www.youtube.com/channel/UCmQjPNEjSZ_pXTsKlcKlfhw)).

While these laboratory exercises and final projects address many important controls elements, several other key elements like multi-degree-of-freedom control do not currently have hands-on examples. As a Class of 1969 CETL Teaching Fellow, I began developing new ways of allowing students to interact with the material. In particular, I was focused on creating a learning module that allowed students to apply interdisciplinary concepts, compare different control strategies from class, and iteratively try different ideas without worrying about failure. I implemented my project using a desktop quadrotor system, which can be operated indoors without a license. Students are asked to derive the dynamic model and the multi-input multi-output control system for balancing in multiple axes. I piloted this element



Figure 2: Students working on the Segway lab

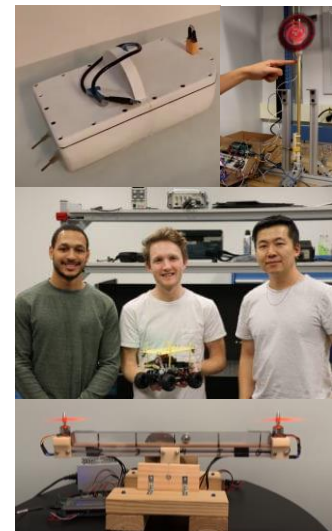
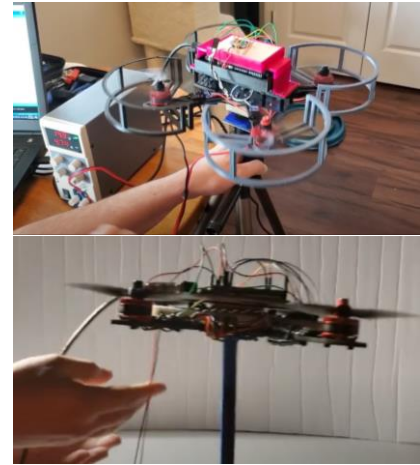


Figure 3: Final project examples from ME 4012



in my class in Fall 2020 and some examples of student work are shown in Fig. 4. Students really enjoyed working with the kits and learning about how quadrotors work. Many of them were excited to apply these concepts in their future jobs or as part of hobby projects. I presented different elements of this new teaching tool at the CETL Celebrating Teaching Day poster session events in 2020 and 2021.

Through reconstructing the ME 4012 class, I have created several new teaching elements that provide multiple modes of learning the same concept and show how problems can be applied to real life. This allows students to learn by making connections to several different elements in class and gives students multiple attempts to learn a concept. Through these elements, I hope to encourage students to become more excited and more knowledgeable about controls, automation, and robotics.



**Figure 4:** Class of 1964 Teaching Fellows mounted quadrotor project

### **Accessibility to Students**

Learning is an individual process and teacher accessibility is important for helping each student address gaps in understanding. To facilitate this, I actively engage students during class to ask questions about material they do not understand. After class, I open up the floor to answer individual questions or to help students with their final projects. In addition to attending office hours, students often send emails with questions and I make a point to answer them quickly or to schedule short one-on-one follow-up meetings.

Throughout my time at Georgia Tech, I have met several students who have struggled with classes due to personal, family, or health issues. For these students, I make sure to meet with them, listen to their needs, and make sure that they know that they can approach me at any time. For example, for one student who struggled with balancing a part-time job with classes, I give her individual tutoring lessons, provided extra time on assignments, and gave her the ability to take the test on a later date without requiring an excuse from the dean. For another student who was caring for a sick parent, I made sure to give him chances to redo test problems or excuse assignments all together. Compassion has become increasingly important in the COVID-19 period, where students struggle to find help. In the last few semesters, I have excused several quarantined students from labs and assignments. Through individual mentoring, I have helped many students reduce stress and get back on their feet both in terms of classes and personally.

Maintaining accessibility to students is often not enough to be an effective teacher, since many of the students who need help do not actively go out to find it. Therefore, I schedule a meeting with each team early in the semester to discuss project progress. I make sure to speak with each student in my class and find out their interests and personalities. Every few weeks, I check student progress, identify those who appear to be having a tough time, and reach out to give them options to recover their grades. By giving these students a second chance, I have helped many of them recover their grades. In one example, I spent extra time mentoring a student who was struggling to understand material in my class. By the end of the semester, he was able to construct a 4<sup>th</sup> order nonlinear model of an unstable system for his final project from scratch and implement a linear quadratic regulator controller for it, which is a graduate level concept. Helping students individually has earned me several “Thank A Teacher” notes from students. One example is included below:

*Professor Mazumdar is the most caring and involved teacher that I've had at Tech. Her attention to student needs is unparalleled and constant evaluation of student understanding cultivates a positive learning environment where it's easy to not only succeed but also excel.*

### **Teaching Excellence**

Since my first semester teaching at Georgia Tech, my CIOS scores have consistently ranged from 4.9 to 5.0 for overall effectiveness. My average CIOS score for availability is 4.9 and my score for respect for students has been 5.0 in every semester. For the Fall of 2020 during the COVID-19 shutdown, I received a student response rate of 94% and an overall effectiveness rating of 4.9. This earned me a place on the Class

of 1934 CIOS Honor Roll which serves as a student recognition of excellence in teaching. Although I have only been teaching at Georgia Tech for a few semesters, I have clearly demonstrated excellence in teaching and accessibility to students. Below are some of the representative comments from my CIOS scores.

### ***Comments on Teaching Effectiveness***

- *You're the least 'Georgia Tech' professor I've had in my time here, and that's the highest compliment I can give for a teacher. Even in the weirdness of this semester you went above and beyond to care for students and conduct one of the best courses I've ever taken. Thank you. I learned an exceptional amount in lecture and enjoyed my homework sets, while getting to do a great project that will go awesome on a resume. Online lectures are interesting and well done, sharing the notes online is very nice for reference, and assessments were fair and clear on expectation. Awesome class and very well put together, great job.*
- *All the homeworks were great applications of the topics and tools covered in lecture. I can honestly say that this professor's assignments have been the some of the most instructive I have had in all my years in school. She kept them engaging and interesting. The tests were well rounded and further extensions of the material. I also really appreciated her invitations to guest lecturers and encouraging her students to attend. They provided excellent context for the academic work.*
- *One of best courses I have taken at Georgia Tech. I would strongly recommend this course to my peers who are willing to learn.*
- *Amazing course experience. My favorite course I've taken at Tech.*
- *Homework assignments were amazingly well done. Corelated very well with the lecture material and guided learning.*
- *I loved class. Dr Mazumdar is amazing at teaching and I found the course material very interesting.*
- *The project was really good for applying the concepts worked on in class in a less structured environment than the labs, and I enjoyed getting to work on it.*
- *I loved class. Dr Mazumdar is amazing at teaching and I found the course material very interesting.*
- *Lectures were the best. Dr. Mazumdar is a great lecturer.*
- *She is very knowledgeable and explains complex topics clearly and simply.*
- *The course has multiple methods for learning. From the labs to the project to the homework and the lectures. This variation created a strong background for the students who took the course and I feel that it added a lot for the student to get excited and apply their knowledge instead of just listening to lectures.*
- *I know this is a critical section, for one to receive feedback on where one may need improving. But, I felt Dr. Mazumdar was an excellent and well-rounded professor. She consistently prompted the class to check their understanding and opened the floor to feedback.*
- *The lab component of the class was an excellent complement to lecture material. I have recommended this class to everyone I know.*
- *Dr. Mazumdar is the best instructor in terms of presenting the materials to the student. The flow of the lecture is always organized and scripted and she always offered help and cared a lot about a specific point that the students have a full grasp of the theory and make sure they use it for applications like the labs or the project so that they will be prepared for their future either in research or career.*
- *Amazing teacher, she taught us application of topics in real life and how to reach solution quickly. It wasn't derivation, but more focused on how to apply concepts in real life, which is what all class needs to take away from this class. She focused more on learning rather than stressing students with grades which enabled students to learn even more because they weren't worried about grades, but enjoyed the learning process.*
- *The problem sets were reasonable yet challenging enough to provide exposure to more "realistic" types of problems than I would have been likely to see in a number of other classes.*

### ***Comments on Accessibility to Students***

- *Dr. Mazumdar's care for her students is overwhelming. More than any other professor I've had she has made an effort to give us opportunities so that we learn the material.*
- *I really appreciated Dr Mazumdar's accessibility and willingness to work with me to bring up my grade after an unusually difficult semester for me.*
- *Dr Mazumdar was an amazing professor who genuinely seemed like she wanted her students to learn more about controls design. She answered emails very quickly and instructed well despite the limitations this semester.*
- *Professor Mazumdar is the most caring instructor I've ever had.*
- *Professor cares for students. She always offered to help the students, explain the material until the students came to a good understanding, and was prepared for lecture. She also carried a high expectation from students with most respect.*
- *She's the nicest most compassionate professor I've ever had. She really cares for her students and wants them to learn and succeed. The grades don't really matter to her.*

### **Connections Between Research and Learning**

Creating connections between classroom learning and applications in research are an important part of my teaching philosophy. Many undergraduates do not understand how graduate schools, fellowships, and research works. In my class, I emphasize how they can transition what they learn to research that is currently being done in the field. In order to do this, I give students in my class extra credit to attend and summarize research talks. Many of these talks are organized by myself, since I currently serve as a member of the IRIM seminar committee (focusing on robotics/controls) and organizing chair for the Georgia Tech Fluids Colloquium. These talks give students a sense for how concepts from class can be applied to make ground-breaking contributions and how they can contribute as future graduate students.

Over the last ~2 years, I have had the pleasure of mentoring 21 undergraduates in my research laboratory, 57% of whom joined my lab after taking my class. This semester, I am mentoring 8 undergraduate researchers. These students work on a combination of projects relating to robotics, controls, signal processing, and stochastic system identification concepts taught in my class. I treat my undergrads much the same way that I would like to be treated as an undergraduate researcher. Instead of giving undergraduates mundane tasks, I interview each of them to determine their skills and interests and give them a small project of their own. Some of these students have contributing immensely to funded research projects while others have focused on fundamental ideas. Graduate students monitor their progress and the undergraduates present on their progress in group meetings each month. This strategy gives my laboratory a strong sense of unity and, as a result, many undergraduates work in my lab for multiple semesters.

Thus far, 8 of my undergrads have first-authored or co-authored conference papers, journal papers, and patents based solely on their undergraduate research. Thus far, 7 of my undergrads have received the Presidents Undergraduate Research Award (PURA) and 2 of my undergraduates have received the prestigious National Science Foundation Graduate Research Fellowship. Of the 11 students who have graduated, 7 are currently in graduate school (many at GT), 2 are awaiting graduate school admission results. Most of these students have maintained interest in robotics, controls, and automation. Two of my former undergraduates, R. Balak and A. Zheng, are current graduate students in my lab and have contributed immensely to research, volunteering, and teaching activities. Below is a selected list of undergraduate researchers from my lab and their contributions based on undergraduate research.

### ***Selected List of Undergraduate Researchers***

- **Ibrahim Abdeally:** ME undergrad, GT 2020 graduate, PURA Spring 2020, Co-first-authored a journal paper for his undergrad research, Current ME BS/MS student at GT.
- **Roman Balak:** ME undergrad, GT 2019 graduate, PURA Fall 2019, First authored a conference paper for his undergrad research, Current Master's Thesis student in my research lab.



- **Beatrice Dias:** ME undergrad, GT 2019 graduate, Co-authored prestigious IEEE ICRA conference paper on her undergrad research, Currently engineer at Yokogawa Corp. of America.
- **Andy Zheng:** ME undergrad, GT 2020 graduate, Co-authored conference paper, journal paper (under review), and patent on his undergrad research, Current Ph.D. student in my research lab.
- **Tyrus Evans:** AE undergrad, PURA Fall 2019, First authored a conference paper and co-authored a journal paper (under review) on his undergrad research, Joining Northrup Grumman in Summer 2021.
- **Yaw Mensah:** Visiting EE undergrad researcher, U. Tennessee 2020 graduate, GT SURE robotics program student, NSF GRFP Fellowship recipient, Co-authored prestigious IEEE ICRA conference paper on his undergrad research, Currently a Ph.D. student in the ECE department at GT.
- **Jaylon Uzodima:** Visiting Physics undergrad researcher, Jackson State 2020 graduate, GT SURE program student, NSF GRFP Fellowship recipient, Co-authored a conference paper and journal paper (under review) on his undergrad research, Currently a Ph.D. student in AE at GT.
- **Aria Amthor:** ME undergrad, GT 2020 graduate, PURA Spring 2020, Currently ME BS/MS student at GT.
- **Houston Comer:** ME undergrad, GT 2020 graduate, Currently ME BS/MS student at GT.
- **Sam Robison:** Applied Physics undergrad, GT Fall 2020 graduate, Awaiting grad school admissions.
- **Jordan Ellis:** ME undergrad, GT Fall 2020 graduate, Currently Engineer at GTRI.
- **Alice Kramer:** ME undergrad, GT Fall 2020 graduate, PURA Fall 2020, Awaiting grad school admissions.
- **Joshua Kim:** ME undergrad, PURA Fall 2020, Co-authored journal paper (under review), Current undergrad researcher.
- **Vishesh Gattani:** ME undergrad, PURA Spring 2021, Current undergrad researcher.

### **Impact on Students**

True impact on students extends from the classroom all the way to student lives after graduation from Georgia Tech. I have assisted many students with graduate school, scholarship, fellowship, and job applications and I have written students over 45 recommendation letters, which have helped many of them get their positions or awards of interest. In ME 4012, I emphasize that students should do a good job on their final projects and use them for interviews and job searches. As a result, many of them use the final project in resumes and design portfolios. One of the students in my class (J. Vallejo) was able to use his final project presentation directly for a job talk. Another student used his class project video to get interviews from companies at the career fair. A third student leveraged his controls expertise from my class to get a funded Ph.D. position at Georgia Tech. Through her excellent work in as a teaching assistant in my class, Dr. Euisun Kim, was able to get a teaching position at Georgia Tech and has received full-time teaching offers at other universities.

One of the students from my research lab (J. Ellis) successfully used his knowledge of Kalman filters taught in my class to find a full-time position as an engineer at GTRI focusing on robotic systems. Another one of my undergraduate researchers (B. Dias) is currently implementing her knowledge of sensors and controls as an engineering at Yokogawa Corp. Finally, T. Evans has used the network he has built through attending research conferences and internships to find a full-time position at Northrup Grumman. Many of my other students have also done internships at Sandia National Laboratories (S. Robison), MIT Lincoln Labs (A. Amthor and T. Evans) and other companies around Atlanta (R. Balak and I. Abdeally).

Providing opportunities to students with diverse backgrounds is an important part of my work. I have mentored with 5 females, 2 Hispanic, and 2 African American undergraduates during my time at Georgia Tech. I have helped many of these students write papers, win awards, and gain admission to graduate school. For my contributions to promoting diversity and inclusion, I was listed in the Georgia Tech Faces of Inclusive Excellence in 2020.

### **Teaching and Learning Outside the Classroom**

Outside of the classroom and the lab, I have actively organized teaching communities and K-12 volunteer activities. In 2020, I was selected as one of four representatives of Georgia Tech for the University

System of Georgia (USG) Chancellor's Learning Scholars program. For my learning scholars project, I focused on improving the teaching in hands-on laboratory classes. To this end, I have assembled a team of professors from Chemistry, Biology, Physics, Mechanical Engineering, Chemical and Biological Engineering, Material Science, and Earth and Atmospheric Science to discuss ideas for improving safety as well as learning in hybrid, remote, and residential modes. Through our meetings, our group has come up with strategies to reduce student stress, help teaching assistants feel more comfortable interacting with students, improve fairness, and help students understand how their actions can reduce the spread of COVID-19. Many of the recommendations from our discussions and readings have already been implemented by the team members in their respective classes across the institute and we hope to expand our team in the coming semesters. Additional details on our activities can be found at our learning community webpage: <https://sites.gatech.edu/laboratory-flc/>.

Outside of the university, I work extensively with CEISMIC on their K.I.D.S. Club and STEAM workshop activities with Roxanne Francis and Sircous Barnes. Most recently, my graduate students and I have been volunteered to create kits and remote workshops to get kids excited about magnetics, motors, programming, and controllers. We have also worked directly with Tim Cone to organize talks for the Savannah Engineering Explorer Post project which helps expose high school students to engineering. For the G. T. Girls program, we created Arduino kits and created a two-day program to teach middle school girls how to create simple programs to flash LEDs, drive fans, play sounds, and detect humans with a microcontroller. Many of the students enjoyed our activities immensely and stated how our activities were their favorite from the entire program.

Education does not stop in the classroom or in the research lab. To expand our impact, I often encourage my graduate students to volunteer or serve as judges for science fairs, robotics competitions, and K-12 activities. By getting students of all levels excited about learning engineering concepts and asking them to pass those lessons on to others, I hope to organically grow participation and interest in engineering. I have found that teaching, education, and mentoring are extremely rewarding and hope to pass on what I have learned to future generations.

February 28, 2021

Re: Recommendation Letter for Dr. Ellen Mazumdar for the CTL/BP Junior Faculty Teaching Excellence Award

Dear members of the award selection committee,

I am writing this letter in enthusiastically support of Dr. Mazumdar's application for the CTL/BP Junior Faculty Teaching Excellence Award. Dr. Mazumdar is the teacher that all engineering students would love to have, a perfect communicator, highly knowledgeable subject matter expert with a very professional but at the same time inviting and welcoming attitude. I first met Ellen when she joined the faculty of the Woodruff School of Mechanical Engineering in January 2019 and I have had the pleasure to serve as one of her mentors since June 2019. In my role as her mentor I have become very familiar with her numerous research accomplishments and her passion for teaching. She aims and works very hard for excellence in all aspects and teaching is no exception. She is dedicated to her community and to enabling our students to reach their potential.

Dr. Mazumdar has mainly been teaching "ME 4012 Motion Controls" an undergraduate elective course in high demand. Although the course existed in the books it had not been taught for years due to the retirement of the faculty who developed it. As soon as Ellen joined the faculty she made it her personal mission to not only revive the course but update the material and include new lab exercises. She has offered the course multiple times with her CIOS scores in the range of 4.88-5.0, even when the course was offered in a hybrid mode due to COVID19. I had the opportunity to observe Ellen in classroom. I attended in one of her lectures for the ME 4012 course, which has both a classroom and a hands-on laboratory component. In the first few minutes, it became obvious that Dr. Mazumdar has put so much thought and planning into organizing and presenting the material, which is math heavy and involves coding in Matlab in real time. She provided a summary and connection to the material covered in last class and an overview of what will be covered. She reminded students of all upcoming due dates for homework and assignments. She alternated very smoothly between writing and sharing notes using the overhead projector and demonstrating the theory she was just describing by coding in real time and sharing her screen. She took time to address the students' questions throughout the lecture to ensure that students could follow along. I was very surprised when after the lecture was over, she stayed on for more than 15 min to address questions and discuss concepts with the students. I was very impressed how engaged students were, taking notes and asking questions.

Dr. Mazumdar has a very welcoming attitude and her calm demeanor and clear instructions create a stress-free learning atmosphere during her lectures. She poses questions and then provides enough time and finds ways to get a conversation going. This is in contrast to the teaching style that the students are often given in the virtual teaching mode, where most students keep their cameras and microphones off and do not participate. It became clear to me that her students love her and that she showed them mutual respect. This is also obvious from the letters and the comments she receives from her students. Dr. Mazumdar is a passionate hard-working teacher who enjoys working with undergraduate and graduate students.

For all these reasons, I strongly believe Ellen would be an exceptional selection for the CTL/BP Junior Faculty Teaching Excellence Award. She serves as an example for many of us and as a role model for our students, a true inspiration especially for our female students interested in robotics and automation.

  
Kyriaki Kalaitzidou

*Associate Chair for Faculty Development and Rae S. and Frank H. Neely Professor  
Woodruff School of Mechanical Engineering and School of Materials Science and Engineering, GaTech*

Dear selection committee,

It is my pleasure and honor to write in support Dr. Ellen Mazumdar for the CTL/BP Junior Faculty Teaching Excellence Award. In the fall semester of 2020, Dr. Mazumdar was my professor for ME 4012: Motion Systems. Within the first week of lecture she graciously extended an invitation for her students to pursue undergraduate research in her laboratory, an offer I immediately took up. I became a research assistant in her lab, the Sensing Technologies Laboratory, and spent the semester working on an electro-mechanical relay for soft robotic applications.

Dr. Mazumdar's lab was my first exposure to academic research, but I was welcomed with open arms by everyone in the lab. The environment she creates is one of motivation and curiosity, where her students are given the freedom to explore their own ideas while being provided the support they need to succeed. The undergraduate research assistants in the lab are able to shape and guide their own projects, a surprise that contrasted my preconceived notion of what undergrad research was like. In meetings, Dr. Mazumdar was encouraging and interested in everyone's findings and always had informed recommendations and comments that helped drive improvement.

In her class, Dr. Mazumdar's teaching techniques were able to overcome the difficulties of the ongoing pandemic by keeping the lectures relevant and interesting. Her active interest and passion in her instruction made it much more impactful and memorable to the extent that I took an active interest in pursuing control system engineering as a career and research area. Sadly my experience with Dr. Mazumdar only began in my last semester of my undergraduate experience, but I attribute my success in obtaining a full-time position at the Georgia Tech Research Institute to her teaching and experience within her lab as an undergraduate researcher. Through her excellence in teaching and conveying complex ideas I was able to demonstrate knowledge beyond what's expected of undergraduate candidates, and in my interview process, I used knowledge from Dr. Mazumdar's lectures and how she related it to real world systems to prove my competency in a controls related field.

Dr. Mazumdar encouraged collaboration with peers in her class, which played a much more natural role than any other experience that I had in my time as an undergrad. The method in which she extended aid to each and every group as we tackled self-driven and open ended problems allowed for an amazing mixture of guided and self-provoked learning. She took an active interest in her students' final projects and was easily accessible even with the difficulties of distance learning. Dr. Mazumdar was always very approachable in any context and more than willing to clear up any confusion.

Overall, Dr. Mazumdar stood out from other professors due to her passion, leadership, and interest in her students' success. It is for all of these reasons I have stated here that I believe she is deserving of this award.

Sincerely,

Jordan Ellis  
Georgia Institute of Technology  
Graduated Fall of 2020  
GTRI-ATAS-RASD Collaborative Autonomy Researcher REI

February 24, 2021

Dear Selection Committee,

It is my delight to recommend Dr. Ellen Mazumdar for the CTL/BP Junior Faculty Teaching Excellence Award. I had the privilege of taking Modeling and Control of Motion Systems with Dr. Mazumdar in the fall of 2020. After having experienced both her teaching and her kindness, I believe her to be firmly deserving of this award.

On the first day of class, Dr. Mazumdar showed the class videos of projects students in her class had completed in prior semesters, as well as of projects which had been completed in her lab. Immediately she drew me in with the applications for the material we would be covering in class, and showed what real world applications the class would have, something which is not necessarily always clear in a classroom setting. Moving forward through the semester, she lectured in a way that was clear, concise, and kept me engaged through the whole class period. There was never a moment when I found myself bored in lecture. Each detail of material she gave was useful and valuable. In addition to regular lecture, Dr. Mazumdar would send out links to talks and conferences on robotics and controls for the class to view, and assign summaries of the talks as extra credit. In this way she encouraged her students to see how the principles in class are currently being applied in research settings, and to learn applications beyond what could be covered in the scope of the classroom.

In addition to her ability to keep the student engaged in lecture, she is highly accessible outside the classroom. On one occasion, while working on a project for the class, my partner and I emailed her with questions regarding how best to proceed given the feedback we had gotten on the last update we had turned in. Not expecting an answer within the same day, we called the meeting. However, we had a thorough answer from her within the next few hours. And this is far from the exception. While I was not able to attend Dr. Mazumdar's office hours due to scheduling conflicts, she was more than willing to schedule times to answer my questions, and any questions I sent her by email were always answered with notable promptness and with full and clear answers. Her accessibility and the depth she put into answering questions aided me not only in my own efforts to accomplish the homework or the project steps I was working through, but also in how well I learned the material in general.

The most important reason I have to recommend Dr. Mazumdar for this award is because of the clear care she has for her students. Over the course of the semester while taking her class, I found myself dealing with some personal issues which negatively affected my academic performance. I came to her to ask how best to proceed and save my grade, and she responded with kindness and grace and allowed me to rework the last test and homework assignments I had failed to complete. Through this, she did more than show the real kindness of giving the opportunity to avoid letting



circumstances I could not control affect my GPA. She also gave me the opportunity to learn the material I had not been able to process before that point. This is a beautiful thing to find in a teacher. The care she shows for the well being of her students and the opportunities she gives to learn have left an impact on me.

In conclusion, Dr. Mazumdar is an exemplary educator. Through her instruction she encourages learning in the fullest sense both inside and outside the classroom. The care she shows for her students and her desire to see them learn is something that has made a personal impact on me, and it will stick with me. It is fitting to award excellence in teaching and education, and Dr. Mazumdar is the most deserving professor that I know of this award.

Sincerely,

Julia Kerns  
Georgia Institute of Technology  
4th year Undergraduate, Mechanical Engineering

Dear Members of the Selection Committee,

When Dr. Ellen Mazumdar reached out to me to write a support letter for the CTL/BP Junior Faculty Teaching Excellence Award, I eagerly jumped on board to help. In my four years at Georgia Tech, Dr. Mazumdar has been one of the most passionate professors I have met; she takes on her role as an educator with a distinct mixture of seriousness and enthusiasm. I am currently an undergraduate researcher in her Sensing Technologies Laboratory and have previously taken her ME4012 Motion Systems course in Fall 2020. While I have only known Dr. Mazumdar for a little more than a semester, I can tell she is an extraordinary professor, teacher, and advisor who not only guides and supports students in their academic goals and pursuits but is also incredibly understanding and thoughtful towards both her students and the work she does.

Fall of 2020 was a difficult semester, in which everyone was returning to campus to resume classes during the Covid-19 pandemic. Students and staff alike struggled with adjusting to the new social distancing guidelines. Despite these challenges, Dr. Mazumdar was well-prepared with her lecture material and lab structure; she continued providing us students with a rigorous yet well-considered curricula that took into account the challenges we all faced in such a unique time. Although her lectures and notes were always given live on BlueJeans, she made sure to make the material accessible by uploading her notes and recordings for each lecture for students who may have missed the lecture or wanted to review the recordings. She expressed her understanding for the struggles we encountered as students, especially under these stressful circumstances and made sure to provide open-channel communication directly with her via BlueJeans and email. Among the courses I took that semester, Dr. Mazumdar was undoubtedly one of the most compassionate and well-prepared professors; she put the time and thought into revising the curriculum to best accommodate the coursework to maximize what she could teach during a pandemic.

ME4012 was a challenging course. Dr. Mazumdar herself recognized and acknowledged this. To address this, Dr. Mazumdar styled her lectures and notes to demonstrate and explain rather than to read and memorize. What greatly facilitated me performing well in the course was her grasp of the course material and especially knowing when to provide her own intuitive explanation for complex topics that students would normally struggle with. She did not stop at just providing the simple textbook definition, but she also tried to apply her own understanding in how to break down and comprehend the subject matter. Dr. Mazumdar was also very receptive to questions. She did not simply provide answers. She responded with well thought-out feedback and explanations that helped to develop a deeper understanding and sometimes added questions of her own to prod me in the right direction.

Even though I have only been in her research lab for a relatively short period of time, the lab structure and communal spirit has left a strong impression on me from the get-go. Even though everyone appears to be working on their own research and projects, there is an unspoken sense of cooperation and unity within the lab. This is attributed to Dr. Mazumdar's effort in not just being the head of the lab, but also as a fellow team member who approaches everyone with the same friendliness and respect. During lab meetings, Dr. Mazumdar works to keep a conversation going and get to know everyone in the lab. After each person speaks about the

project, she always provides some follow-up comments and livens up the energy and atmosphere, maintaining an environment open to discussion and questions.

If you were to ask me what separates Dr. Mazumdar from other professors, I would say it is simply her sincerity in trying to help students toward their own goals. When talking with Dr. Mazumdar, the conversation is more of one between friends rather than that of student and faculty. As a prospective graduate student, I had many questions and concerns about the process and the cost benefits of pursuing a graduate degree. I reached out to Dr. Mazumdar for her perspective and advice, and I was amazed by how friendly and thoughtful she was receiving my questions. She helped walk me through what she believed would be a few courses of actions based on my background and goals. One thing that stood out to me was that she gave me her honest opinion about what I should expect and was not afraid to be blunt, which was very refreshing, and something I really appreciated.

Overall, Dr. Mazumdar is genuinely one of the most approachable and considerate professors I have known here at Georgia Tech. She embodies the many qualities and characteristics of an educator who looks to teach and guide students in a tough academic environment. I cannot recommend Dr. Mazumdar highly enough for this award.

Sincerely,

George Niu  
Georgia Institute of Technology, Class of 2021  
B.S. in Mechanical Engineering