Madi Babaiasl – Teaching Statement

Introduction

Roboticists define Mechatronics as "the synergistic integration of mechanical engineering with electronics and intelligent control for the creation of products." This means that the interdisciplinary subject, Mechatronics, produces systems that are better than if the constituent disciplines were used alone. My teaching philosophy is based on principles of effectiveness [1, 2], and synergistic collaboration is the essence of my principle-centered teaching and mentoring. Synergy means bringing students/advisees together and unleashing their potential to produce a greater good. Synergistic collaboration occurs when differences between students/advisees in teams are valued, acknowledged, and respected, strengths are built upon, and weaknesses are compensated for.

As an educator, my lifelong mission is to deliver robotics, mechatronics, and artificial intelligence education to students through *experiential learning* [3], and I am committed to equipping them with lasting skills. Besides becoming experts in their fields, graduate students will learn how to communicate effectively and adhere to scientific ethics. Undergraduate Students will learn how to evaluate complex problems critically. At all levels of education, my goal is to promote an attitude of inquisitiveness and enthusiasm for scientific discovery. Also, I consider myself a lifelong learner, so I will constantly update my knowledge, proactively reflect on my performance by getting feedback from my students, and use research-backed new techniques for teaching, like "experiential learning" [3] and "flipped classroom" [4] techniques.

Interests, Experience, and Effectiveness

My background prepares me particularly well for teaching graduate robotics courses and undergraduate robotics, mechatronics, system dynamics, and control courses. For Mecharithm, which will be a comprehensive platform for roboticists from job matching using ML and AI algorithms to learning to news, I have developed or co-developed different courses, such as robotics fundamentals, mechatronics fundamentals, virtual reality, augmented reality, and machine learning, to name a few (Fig. 1 - top).

Additionally, as a graduate teaching assistant, I have assisted with the teaching of several large undergraduate courses, such as Mechatronics and System Dynamics. In particular, we developed kits and models to teach Mechatronics through hands-on, project-based learning (Fig. 1 - bottom). For my role in this class, I consistently received excellent evaluations from students and was nominated for the best teaching assistant award. Here are just some examples of student feedback:

- "*You were the best TA that we could have asked for. It's clear that you care about the students and go out of your way to help out. I did very well in the class, and I think it was because I went to your office hours when I was confused, and I made it to every lab session with you. You did a great job, and thank you!!*"
- "*I'd definitely say you were the most helpful and best TA I've had yet in the school of MME here. As far as time spent specifically for the students, I feel you invested equally, if not more, time than the professor himself. Unlike most TAs, you weren't out to do the bare minimum asked of you.*"
- "*Thanks for being such a great TA for 348 and this class too, really helped my understanding of the subject matter!*"

Experiences such as my success as a TA in the Mechatronics course have filled my interest in teaching/developing courses in Robotics, Mechatronics, System Dynamics, and Control, along with incorpo-

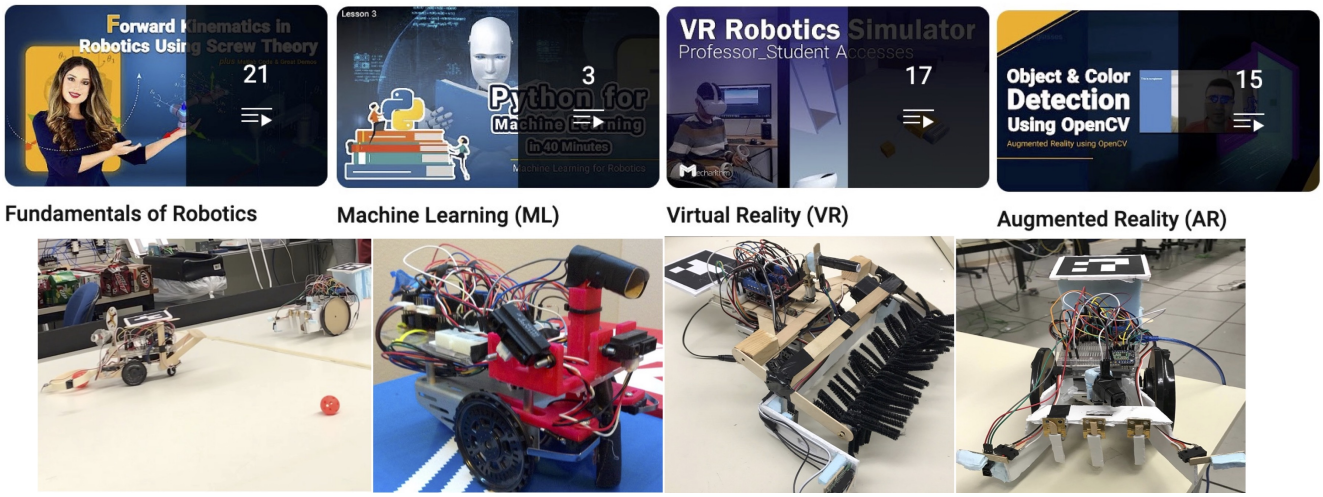

Figure 1: (top) Some of the lessons that I developed or co-developed at Mecharithm. (bottom) Some of the projects that students have done for the Mechatronics course.

rating the applications of Machine Learning, Artificial Intelligence, Machine Vision, Augmented Reality, and Virtual Reality into Robotics and Mechatronics courses.

Graduate and Advanced Undergraduate

In graduate courses, students acquire knowledge and tools that are likely to be directly applicable to their long-term career goals and research. For advanced classes, I plan to incorporate current literature topics into the curricula and ask students to incorporate the knowledge gained into a project that can benefit their own research. The teaching is based on a combination of *flipped classroom* [4] and *experiential learning* [3] techniques where the students will first watch a video version of the lesson that uses a project-based, example-based and fun approach to teach complex concepts (An example of me teaching complex principles of robotic kinematics through my Mecharithm Youtube Channel can be seen at this link) and class time will be dedicated to problem-solving, brain-storming, and projects. Labs are essential to the teaching of robotics and mechatronics, so I will develop kits and models for each lab, and students will also complete mid-term and final projects. I and my TAs will provide detailed feedback on homework assignments and projects so that each student can reflect on and improve their performance, and we will assess each student based on their own progress (I envision each student having a profile that tracks their learning progress over time). I will give more weight to homework assignments and projects, but I will also take formal quizzes and exams. Most of the teaching methods here are applicable to undergraduate education as well.

Undergraduate Education

It is common for students to take lower-division courses without intending to apply them to their careers in the future. Therefore, my goal in these undergraduate courses is to ensure that students leave with more than a comprehensive knowledge of the material. I aim to develop students' abilities to evaluate and solve complex problems, as well as to instill a solid appreciation for engineering in their daily lives.

Maintaining momentum requires student engagement. It is essential that I convey sincere enthusiasm myself in order to keep my students interested and motivated. I often illustrate new topics with relatable examples: medicine, cars, industry, etc. For students to feel welcome, I regularly announce upcoming office hours and curate an online forum for them to ask questions.

Mentorship in Research

Advisors play a crucial role in encouraging student researchers to develop self-motivation and independent thinking. Firstly, I will lead by example: students will see how diligently and conscientiously I work and how enthusiastic I am about our research. During weekly individual meetings, I will encourage group members to propose questions and hypotheses about their research project, as well as to plan achievable weekly objectives that will move them forward. By recognizing the strengths of each student, I will ask them to use their strengths to assist the group (e.g., mentoring younger students, taking on group projects, leading discussions). Additionally, we will have weekly lab meetings during which students can receive feedback on their research, discuss literature, and review safety topics. I will encourage students to develop their communication skills through presenting posters and talks at conferences, drafting manuscripts on their work, and preparing the text, audio, or video descriptions of their published research for general audiences.

References

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[2] Stephen R Covey. *Principle centered leadership*. Simon and Schuster, 1992.

[3] Maki K Habib, Fusaomi Nagata, and Keigo Watanabe. Mechatronics: Experiential learning and the stimulation of thinking skills. *Education Sciences*, 11(2):46, 2021.

[4] Joshua Collado-Valero, Gemma Rodríguez-Infante, Marta Romero-González, Sara Gamboa-Ternero, Ignasi Navarro-Soria, and Rocío Lavigne-Cerván. Flipped classroom: Active methodology for sustainable learning in higher education during social distancing due to covid-19. *Sustainability*, 13(10):5336, 2021.