Teaching Statement

Aditya Penumarti

Every engineering model is approximate. Students understand these models best when they can determine the conditions under which the models hold and fail. They are presented with derivations and assumptions, but they do not see what happens when the assumptions are violated. Once applied to hardware, these models encounter friction, saturation, and noise. I plan to incorporate experiential learning into theoretical courses, enabling students to explore the connection between equations and physical systems through guiding questions rather than straightforward answers. This helps cultivate a mechanical engineering student's engineering judgment.

From derivation to hardware: I first implemented this while co-developing EML4842C Autonomous Vehicles at the University of Florida with Prof. Carl D. Crane III, where I designed the 1/10th-scale autonomous vehicles, assignments, and lectures. One early lecture-and-lab module asked students to implement controllers that allowed the vehicle to follow a wall. I guided students through questions such as "*When the proportional gain is multiplied by the error, what value do you get? Can the steering servo actually perform that command?*" This lets students see the specific limits of actuation resulting from their gain selection. Students also worked through instability and noisy observations, learning the value and the limitations of the derivations presented in class. Students have told me that the hands-on work helped them bridge conceptual gaps to real systems.

Practical Assignments: In the autonomous vehicles class, we primarily performed oral check-offs in groups, as working code alone did not show whether students understood why it worked. However, this left no written record of students' development of reasoning over the semester. In my future courses, I will use an open-ended report with some oral assessment. The reporting requirements allow students to represent their knowledge in written, academic form. In the oral component, with Socratic and peer prompting, they discuss how they troubleshoot and formulate their systems. This lets me assess whether students develop engineering judgment. Open-ended assignments allow students to explore and write reports on topics beyond the core components, thereby helping them take ownership of their learning.

Mentoring: As a Ph.D. student at the University of Florida, I directly mentored five students, two undergraduates and three graduate students. I pushed the students to grasp core research concepts and develop novel ideas by visualizing the foundational assumptions in the simplest systems. All five students have gone on to co-author conference papers. Two students have entered the workforce, working for a startup and lecturing at a university. Mentoring these students has helped me develop my role as an educator through cultivating their curiosity, ownership, and deep understanding. I focused on providing structure for undergraduates while engaging in open-ended discussions with graduate students. I aim to enable my students to develop novel ideas guided by first principles, helping them remain adaptable and creative in a fast-paced academic world.

Courses: As a graduate student, I was a teaching or lab assistant for Computer-Aided Design, where I added hands-on GD&T measurement, Mechanics of Materials Lab, and a class on screw theory for robotics. I also designed a five-bar air-hockey robot project for the Dynamics and Controls Lab and gave guest lectures in controls and estimation. I am prepared to teach *courses on dynamics and systems*, *controls*, *robotics* and *computer-aided design* at the undergraduate level and would be enthusiastic to teach *introduction to robots and kinematics*, *optimal estimation*, *probablistic planning and mapping* at the graduate level, bringing the same experiential approach to each. I plan to develop courses on *Autonomous Vehicles* for undergraduates and *Probabilistic Decision-Making for Robotics* for graduate students, a course moving from state estimation to planning under uncertainty, with simulations that show where each assumption fails.