TEACHING STATEMENT
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Interaction with students has been the most rewarding experience of my graduate and postdoctoral career. I have enjoyed this experience in the classroom setting where I taught advanced level courses and in mentoring and guiding undergraduate and graduate students in their research work. My teaching philosophy has always been simple and is guided by two main principles: (1) Make the lectures as interesting as possible and (2) ensure adequate opportunities for feedback on how well the students are grasping the important concepts through creative use of assignments and projects. This philosophy was molded through personal experience in my undergraduate and graduate study.

The best courses I took at the undergraduate level were senior level courses in Kinematics and Robotics while at the graduate level they were courses in Advanced Robotics and Machine Vision. A common part of the undergraduate courses was a weekly 10 minute test on concepts taught in the previous week. Combined with the enthusiasm and patience of the instructor in explaining even the simplest concepts, this forced all the students to actively keep abreast of what was happening in class and resulted in an engaging and stimulating classroom environment. The instructor frequently used examples and illustrations to explain the concepts better and I was especially impressed by how well-prepared the instructor was for all the lectures. These courses played a big role in my choice of field for graduate study and showed me the value of gaining feedback through assignments and homeworks since the instructor would often modify his course material based on his perception of how well we had understood it.

At the graduate level, I was impressed by the practical experience I gained in the Machine Vision course. Emphasis was placed on developing software modules for different aspects of the vision problem. This taught me the important skill of designing systems from scratch and also built my programming skills, an important but often neglected component of research in areas like Robotics. The course in Robotics had a research component which brought out the ability of coursework to build the research skills of students. The research assignment provided me with valuable experience in presenting research ideas to a peer group and in using literature and other research resources effectively.

I aim to bring the same level of involvement to my lectures and I got the opportunity to examine this philosophy at work in teaching an advanced level course in Robotics to graduate students at Penn in Spring 2006. My involvement with the course was in teaching concepts in kinematics starting with rigid body motion using twists and the exponential map to inverse kinematics using the Paden-Kahan sub-problems. I started each lecture with a review of what was done in the last lecture, explained what will be taught in the current lecture and showed how it fits into the bigger picture of what we are trying to do in that part of the course. I was very methodical in preparing for the lectures, preparing extensive notes on what I was going to say, working out examples and, in keeping with the first principle of my philosophy, creating interesting visualization of harder concepts to get them across. I also aimed to create interesting homework problems

that would test the students on what they had learnt in class and force them to think creatively about solving problems using techniques taught in class.

The course also included a project assignment. The students were free to choose any problem within the scope of the course and were required to present their solutions at the end of the semester. This formed a very vital part of the coursework, encouraging several first year students to conduct their first research in areas that they have since chosen for further study. With the same objective, I have also taken the lead in designing reading groups that examine the latest research in Robotics and Control. These groups allow students easier access to a larger volume of the latest research and have led to useful collaborations between different research groups.

At the end of my involvement with this course, I received valuable feedback from the students that I am planning to use to improve on my teaching for the same course this semester. The most important feedback I received was that I could have done a better job in explaining the relevance of the subject matter through more examples of applications in the real world. I aim to address that in two ways: (1) include real examples from my own work and from current robotics research in an introductory lecture and (2) present more examples from current research for individual topics to show how the concepts can be utilized in applications. I also received encouraging feedback from several students with one student and current colleague telling me that he uses concepts like twists, exponential maps and the product of exponential formulation in his current work, even though his area of research is not kinematics, since “it makes so much sense to do it that way”.

I have extensive mentoring experience throughout both my graduate and postdoctoral career. I guided several students in undergraduate senior design and summer projects and two of them won best senior design prizes in the Department of Mechanical Engineering at Penn, one for her work with developing behaviors for robotic soccer with legged robots and the other for designing and building a rollerblading robot. I have also guided several graduate students and have been able to spark their interest in particular research areas that eventually led to the first publications for these students. A design exercise for a novel robot performed with a graduate student eventually led to a third place standing for the student in the ASME Design contest in 2006.

I have also been involved in developing lab components for courses starting with a Mechatronics lab I designed for senior-level undergraduates at IIT, Bombay. I was involved in designing lab exercises as part of a Robotics course for Masters students at Penn. I found that lab exercises help greatly in explaining practical concepts and form an essential part of both the undergraduate and graduate experience, especially in giving students the confidence to tackle practical problems and in developing experience in experimental research.

An essential part of the teaching curriculum is also to develop new courses that explore new areas and teach the state of the art in Robotics to keep students up to date with the latest trends in Robotics. I believe I can effectively teach undergraduate and graduate

level courses in Robotics, Kinematics, Dynamics, Mechatronics and Control. I would also like to design new courses, including lab components, in nonlinear control theory and specifically in locomotion.