TEACHING STATEMENT

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Past Experience. I always remember that time affectionately, when my eighth-grade English teacher asked in his class if there was anyone who would take teaching as a career and I raised my hand. After high school, when I opted for a degree in electrical engineering, I had already set a goal for myself to go into academic research. Therefore, in addition to running tutorials for various courses, I established informal reading groups on *digital signal processing*, *dynamical systems*, *image processing* and other subjects that were not part of undergraduate curriculum at that time. Even during my brief stay in the industry, I kept my passion for teaching alive by teaching an in-house intensive course on *optimal estimation* and *sensor fusion*.

During my graduate studies at Georgia Tech, I was a teaching assistant for two graduate-level courses in electrical engineering : *Optimal Control* (ECE-6553, spring 2005) and *Linear Control Systems* (ECE-6550, fall 2005). I substituted the concerned professors many times in their absence for delivering lectures and helped in grading and examination. These courses were attended by more than fifty students from different departments in each class and video recorded for distance-learning students.

At McGill University, I am teaching an introductory undergraduate course in computer science: *Computers in Engineering* (COMP-208, Winter 2008). As the principal lecturer for the course, I have more than 70 students from Civil, Mechanical and Chemical engineering majors, basic programming skills in FORTRAN, C++ and numerical analysis. I am also running a reading group on *computational algebraic topology*, which is being attended by 4 professors from CS, postdocs and graduate students from Math, CS and engineering. The objective of these readings is to familiarize graduate students in mathematics to the emerging applications of computational topology in science in engineering. Since, I am preparing most of the presentations, maintaining a webpage for the group, and organizing material, I hope to use these meetings as a dry-run for a future course in this subject.

Teaching Philosophy. These experiences have helped shape my teaching philosophy for three distinct areas : undergraduate teaching, graduate teaching and advisory duties. It is my belief that undergraduate and graduate courses should be taught in a very different way — undergraduate teaching should emphasize motivation whereas rigor should be of central importance for graduate students. Thirdly, mentoring graduate and undergraduate students in an advisory role is equally important to teaching courses in which choosing the right blend of motivation and rigor for each student is quite challenging.

1. Undergraduate Teaching. Undergraduate classes should be fun and accessible. It should be recognized that undergraduate students come from a wide range of background and ability. Not every undergraduate student goes on to become a researcher. Therefore, the teacher should deliver lectures according to the median ability of the class. At the same time, she should be able to meet the objectives of challenging the brightest students of the class and communicating the course material to those who struggle.

These goals can be achieved by strengthening undergraduate engineering courses with laboratory exercises and practical demonstrations whenever possible. Engineering is by definition a *practical* subject. Therefore, even theoretical subjects like information theory and electromagnetics should be motivated by examples from real-life engineering practice. Moreover, students are entitled to learn and appreciate the beauty of the underlying mathematical foundations. I consider myself most fortunate that I was exposed to engineering practice in industry for many years as well as to the very foundations of mathematics in my graduate studies. Thus, I intend to use my experience to motivate the students in both of these aspects.

2. Graduate Teaching. In contrast to undergraduate students, I believe that graduate students should already be motivated enough to take a particular course. Therefore, it is most important that the teacher reciprocates this motivation with rigor and exposition. This will not dampen the enthusiasm of the students but instead give them their time's worth in understanding a subject fully and deeply. The

method of keeping such lectures interesting to the students is not to dilute the content but to keep the teaching style fresh and enjoyable. Such methods include the citation of historical facts about the development of the subject, giving pointers to its resonance with other fields in science and engineering, and pointing out open problems and emerging areas.

3. Advisory Role. As mentioned above, working as an adviser for undergraduate and graduate students is perhaps the most challenging yet enjoyable part of a teaching career. I am a great believer in harnessing the enthusiasm of advanced undergraduates and that this is an under-utilized asset in the research universities. They should be encouraged to participate in research projects, laboratory exercises and preparation of teaching material for junior classes.

For graduate students, a lot depends on their individual talents. The adviser is instrumental in recognizing their peculiar talents and allowing them to harness their capabilities for producing the best research. In my opinion, this can be achieved by giving students the freedom to seek guidance beyond their advisers, funding them to attend conferences and workshops, helping them form research collaborations, encouraging them to make independent reading groups, and to take courses outside of their particular area of interest. I myself enjoyed this intellectual freedom and have benefited from it immensely. Good graduate students need not be a shadow of their advisers, rather they must be able to define their own area of expertise.

Course Development. In the near future, I intend to focus on two aspects of my teaching. One is the teaching of traditional courses in electrical engineering and computer science. I would particularly enjoy teaching undergraduate courses in *signals & systems*, *electromagnetics*, *electrical circuits* and *digital systems*. For graduate students, I find myself well motivated to teach introductory and advanced courses in *control theory*, *robotics*, *information theory*, *signal processing* and other aspects of systems and control.

The other aspect of my teaching would include course development in two new areas. One is the emerging field of *distributed systems* with emphasis on *sensor networks* and *robotics*. Since this is an emerging area, there is as yet no textbook or standard teaching methodology. To keep abreast of the high volume of research produced in this area, I intend to develop a course that surveys the most important research published so far. Secondly, as mentioned above, I am developing a course that surveys the diverse applications of *computational algebraic topology* in science and engineering. The audience of such a course will be graduate students in diverse areas of engineering, physical sciences and applied mathematics. I have already surveyed this area with various groups of students in the form of reading groups and short winter schools. I feel confident that this effort will lead to a standard course and possibly a textbook in the coming years.

Personal Goals. The common denominator in all of these efforts is that I want to demonstrate to my students that the solution of some of the hardest engineering problems requires the appreciation and understanding of sophisticated mathematical tools. That machinery needs to be understood and further developed by engineers. Moreover, engineers need not and should not distance themselves from practical problem solving by immersing themselves in technique alone. Engineers are problem solvers and not 'problem inventors'. A balancing act between these two ideas is what makes a good engineer. Sharing this illumination with newcomers to science and engineering would be my passion and joy. I feel that propagating this belief can further motivate and inspire students towards appreciating higher eduction in the mathematical and engineering sciences.

On a more personal level, I consider teaching as a form of community service. Since I myself come from a very poor part of the world, I wish to help establish institutes and research programs in the third world, maintain liaison with students and scholars residing there, and to encourage the minorities and the underprivileged in the United States towards science and engineering. Needless to say that these steps coincide with the highest goals of education : character building, poverty alleviation, social justice and the advancement of knowledge. In my small capacity, I have already taken some practical steps in this regard and intend to continue and expand on this theme in the future.