Statement on Teaching
Gunnar Martinsson, Department of Applied Mathematics, August 28, 2009.

Teaching philosophy: I believe that mathematics is a subject that must be learnt by working exercises, and that one of the principal challenges facing the teacher is to actually get the students to spend more time working problems than they do on reading the texts. Almost all teachers mention the importance of working problems, but it has been my experience that many students will not follow the advice unless all components of the class are designed to encourage problem solving, and are designed well. It is of core importance that the problem sets be stimulating, that they address the specific concepts being covered in class, and — importantly — that they be neither too easy nor too difficult. If they are too easy, the students do not learn, and conclude that they can skip problem solving entirely. If they are too hard, the students may give up on trying to *understand* the material and conclude that their only chance is to rote learn how to solve what they presume to be "typical" exam problems. It is therefore important that problem sets contain problems of different difficulties: some problems that all students solve; some that challenge most of the students; and one or two that challenge the best students (that are clearly marked as difficult).

When I design classroom lectures, I consider my primary purpose to be to provide the students with a road map over the subject material that they are about to study. Most of the actual learning will happen when they slowly read the material themselves and work the corresponding exercises, but for this to be successful, it is important that they have seen that what might come across as an intimidating piece of text can be broken down into small, clearly logical, digestible pieces. Another important part of the classroom teaching is to connect the material in the textbook both with other classes (that they have taken, or will take), and with application areas. This is particularly important in an area such as mathematics where the utility of the subject being studied can be hard to discern the first time one encounters the material.

My grading policies are shaped to strongly encourage students to start working problems from the first week of classes. The most efficient way of achieving this is to grade weekly home works that substantially count towards the final grade. When it is not feasible to grade home work, I typically assign about three midterms on which several problems have been guaranteed to the students to be very similar to the home work problems.

Graduate teaching: I taught the two-semester class *Applied Analysis* (APPM 5440 and APPM 5450) in the academic years of 2005/2006 and 2006/2007, and APPM 5450 again in the Spring of 2008. The first time I taught it, I reworked the curriculum, picked a new text book, made the class more focussed on problem solving (via the techniques described in the "teaching philosophy" section), and transformed one of my office hours into a tutorial session where I discussed each week's homework in an informal setting that encouraged student participation. Judging from student reactions (as evidenced by FCQ's and student interviews), the classes were well received. The tutorial sessions were particularly highly appreciated and had essentially 100% attendance in spite of being voluntary. My peer evaluations have also come out very favorably.

Undergraduate teaching: I taught *Differential Equations and Linear Algebra* (APPM 2360) in the Spring of 2008 (with one section of 140 students), and again in the Spring of 2009 (with two sections of 140 students each). Both time, I served as course coordinator of this 400+ student class, supervising the instructors and teaching assistants. I received very favorable feedback from many students. My FCQ evaluations were average the first time I taught the class, and were slightly better the second time. My peer evaluations included recommendations for points of improvement but were overall favorable (they are included in my portfolio).

During the Spring of 2009, I took advantage of the campus FTEP program to conduct a *Classroom Learning Interview Process.* This provided excellent feed-back on both which parts of my instruction style that seem to work well, and which parts could be improved. The main critique was that I sometimes used slightly different notation from the book, and that I did not include enough real-world examples to motivate the material. I enclose the report with this statement.

Before coming to CU, I was an instructor for two undergraduate mathematics classes at Yale (*MATH222: Linear Algebra with Applications*, and *MATH120: Multivariable Calculus*). My student evaluations were significantly above the department average.

Graduate student advising: I am currently advising three doctoral students:

Patrick Young: Co-advised with Kamran Mohseni (AE). Expected to graduate in May 2010. Supported by a department NSF award through the "Mentoring Through Critical Transition Points" program.

Adrianna Gillman: Expected to graduate in May 2011. Supported by NSF award "CAREER: Fast Direct Solvers for Differential and Integral Equations."

Nathan Halko: Expected to graduate in May 2012. Supported by NSF award "CDI-Type I: Geometrical Image Processing with Fast Randomized Algorithms."

Undergraduate student advising: In connection with the department's NSF award "Mentoring Through Critical Transition Points," I am supervising research by Jaeann Dwulet (APPM/MCDB major) and Tracy Babb (APPM major).

Professional goals regarding teaching and advising:

(1) Classroom teaching: Based on direct student feed-back and FCQ's, it seems that I am currently doing a very good job of motivating and training graduate students, and strong undergraduate students, while my ability to excite weaker undergraduate students is only average. I intend to focus my continuing efforts at developing as a teacher on improving in this latter area.

(2) Graduate advising: My goal for the next 3 – 4 years is to keep supporting a group consisting of around three graduate students, and ideally add a postdoc. Longer term I hope to enlarge the group further as the research that I do is very labor intense. My current choice of research directions is strongly motivated by the need to demonstrate to granting agencies that I can produce results both in terms of developing new important technologies, and in successfully graduating and placing students.

(3) Undergraduate advising: My experience with undergraduate advising has been very positive. My students have been strong and interested, and the work has been stimulating both for me and for my graduate students. I hope to be able to organize work in my group to be able to expand these activities, and would be very interested to get more actively involved in the department's efforts in this direction.